

MRP Properties Company, LLC

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Brenda B. Epperson
Manager

Environmental Liability & Remediation Management

October 24, 2014

Chief of the Hazardous Waste Permits Section
Kansas Department of Health and Environment
Bureau of Waste Management
ATTN: Mostafa Kamal, P.E., CHMM
1000 SW Jackson, Suite 320
Topeka, Kansas 66612-1366

U.S. Environmental Protection Agency, Region 7
Air and Waste Management Division
RCRA Corrective Action & Permits Branch
ATTN: Brad Roberts, P.G.
11201 Renner Boulevard
Lenexa, Kansas 66219

Re: **Response to KDHE Comments of September 15, 2014 on the Screening Level Ecological Risk Assessment Work Plan**
MRP Properties Company, LLC – Arkansas City, Kansas
EPA ID No. KSD087418695
VIA FEDERAL EXPRESS TRK#’s: 7716 2217 1237 / 7716 2221 1532

Dear Mr. Kamal and Mr. Roberts:

MRP Properties Company, LLC (MRP) has reviewed the Kansas Department of Health and Environment (KDHE) letter dated September 15, 2014 containing the comments from KDHE and EPA on the Screening Level Ecological Risk Assessment (SLERA) work plan submitted by MRP on August 22, 2014. MRP’s response to the KDHE and USEPA comments are provided in this letter.

The following presents the KDHE and EPA comments (*in italics*) followed by MRP’s responses. The revised work plan pages are also attached.

Specific Comments:

1. *Section 1.2.3 (p. 1-3). MRP states that the current storm water detention ponds will remain in use but is not clear whether or not they will be included in the ecological risk assessment. Please revise this section to note that the storm water detention ponds will be evaluated in the ecological risk assessment.*

Response #1:

This section of the work plan has been revised to indicate that the storm water detention (evaporation) ponds will be evaluated in the SLERA.

2. *Section 2.1.3.1 (p. 2-3). Section 2.1.3.1 describes the groundwater treatment system. Please revise this section to note that the bioreactor tank and oxidation ponds are currently operated under a National Pollutant Discharge Elimination System (NPDES) permit.*

Response #2:

This section of the work plan has been revised to indicate the groundwater treatment system, including the bioreactor tank and oxidation ponds, is operated under a NPDES permit.

3. *Sections 3.1.1 and 3.2.1 (pp. 3-1 and 3-3). Section 3.1.1 states that historical data are not*

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appropriate for the SLERA and therefore will not be used. Instead, results from the 2010 Exposure Unit Supplemental Soil Investigation for the Process Area, Junk Storage Area, and Construction Debris Landfill will be used to evaluate ecological exposures. Further, Section 3.2.1 states that additional soil sampling will be conducted to fill data gaps as described in the Soil Investigation Work Plan for the site. The EPA ecological risk assessors would appreciate a further explanation of soil samples that will be used in the SLERA (a map), how the data gaps were determined, and the areas where the new soil samples will be collected.

Response #3:

It is our understanding that Brad Roberts, EPA will provide the EPA risk assessors a complete copy of the Soil Investigation Work Plan that was submitted to the EPA and KDHE on August 29, 2014. This work plan contains detailed maps showing the location of existing and proposed soil sampling locations and includes a discussion on data gaps. In addition, it is our understanding that Brad Roberts will provide the EPA risk assessors a complete copy of the Surface Water and Sediment Investigation Work Plan that was submitted to the EPA and KDHE on September 19, 2014.

4. *Section 3.2.3 (p. 3-4). Section 3.2.3 describes the proposed protocol for sediment sampling at SWMUs 9, 10, 11, and 23. KDHE acknowledges that the use of BER guidance document BER-RS-006 is acceptable for use in investigation of the storm water ponds but the number of samples stated may not be sufficient for risk assessment purposes. The exact number of samples and sample locations will be addressed in the Surface Water and Sediment Investigation Work Plan.*

Response #4:

Agreed. The Surface Water and Sediment Investigation Work Plan was submitted to the KDHE and the EPA on September 19, 2014.

5. *Section 4.1 and Figure 4-1 (p. 4-1 to 4-4). Overall, the conceptual site model accurately describes contaminant transport, completed exposure pathways, and potentially impacted ecological receptors. However, the EPA ecological risk assessors disagree that ephemeral storm water retention ponds could not support aquatic invertebrates. As soon as puddles form, meiofauna (e.g., ostracods, copepods, cladocerans) will begin to hatch. Meiofauna are predators and prey. The CSM needs to show the benthic invertebrate column as a complete exposure pathway for on-site surface water and on-site sediment. The EPA ecological risk assessors also find that the CSM needs to show benthic invertebrates as complete exposure pathways as prey items and all aquatic invertebrates would come into contact with off-site surface water.*

Response #5:

Agreed. The CSM figure was revised to show the benthic invertebrate column as a complete exposure pathway for on-site surface water and on-site sediment. The CSM text in Section 4.1.2 and 4.1.4 was revised to indicate that on-site benthic invertebrates are prey items for amphibians and aquatic-dependent birds and mammals. The CSM text was also revised to indicate that off-site benthic invertebrates are exposed to off-site surface water.

Response to Comments

October 24, 2014

Page 3

If you have any questions or comments regarding the response to these comments, please contact me at 210/345-4619 or Jay Mednick, MWH at 303/291-2262.

Sincerely,

A handwritten signature in black ink, appearing to read "BB Epperson", with a long horizontal flourish extending to the right.

Brenda B. Epperson

Enclosures: Revised HHRA Work Plan Text, Redlined Text/Tables, and CD

cc: Mark Vishnefske, KDHE BWM w/o enc.

Kent Biggerstaff – MRP Properties Company, LLC

Jay Mednick – MWH

Bruce Narloch – MWH

Screening-Level Ecological Risk Assessment Work Plan for Soil, Surface Water, and Sediment

Former Total Petroleum Refinery
Arkansas City, Kansas

PREPARED FOR:

**MRP Properties Company, LLC.
1400 South M Street
Arkansas City, Kansas 67005**

PREPARED BY:



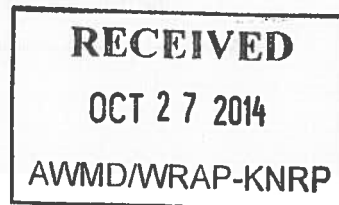
BELLEVUE, WASHINGTON

AND

DENVER, COLORADO

DATE:

AUGUST 22, 2014
REVISED OCTOBER 24, 2014



HHRA work plan for soil and groundwater (MWH, 2014a) and an HHRA work plan for surface water and sediment (MWH, 2014b) were submitted to the agencies on April 28, 2014 and July 18, 2014, respectively, and a soil investigation work plan is in progress.

1.2.3 Future Site Use and Risk Assessment Framework

The Site is currently zoned industrial, and the most likely scenario for future land use at the Site is redevelopment as commercial or industrial properties. Smaller redeveloped properties would likely be almost entirely paved or covered in concrete; however, for the purpose of evaluating ecological exposures in the SLERA, it will be assumed that the most contaminated locations are left unexcavated and uncovered. Terrestrial ecological receptors that forage or live at the Site could utilize any portion of the Site; however, for the purpose of prioritizing areas for potential corrective action, and for consistency with the results of HHRA for soil and groundwater at the Site, the exposure units (EUs) defined in the HHRA Work Plan for Soil and Groundwater (MWH, 2014a) will be used to quantify ecological exposures as well (Figure 2-1).

Under future Site land use, it is likely that the current stormwater detention ponds will remain in use. The evaluation of current potential ecological exposures to media in the stormwater detention ponds are proposed herein and are expected to be protective of any future potential exposures. Use of the active treatment system ponds will most likely continue unchanged until the groundwater protection standards (GWPS) are achieved at the downgradient boundary of the Site. Because the ponds are part of an active treatment system, MRP is not seeking to close these units at this time. Therefore evaluation of ecological exposures to surface water and sediment at these units will be evaluated in a future document.

1.3 PURPOSE AND SCOPE

The purpose of this Work Plan is to describe the methods and assumptions that will be used during the preparation of a SLERA for soil, surface water, and sediment for the Site, including an evaluation of existing data and recommendations regarding additional data requirements. Screening-level ecological hazard estimates associated with impacted soil, surface water, and sediment will be calculated following additional Site characterization to address data gaps for these media.

1.4 ORGANIZATION

This Work Plan consists of five sections, as described below.

- **Section 1.0 – Introduction:** Summarizes the Site background and presents the purpose and scope and organization of this Work Plan.
- **Section 2.0 – Project Setting:** Presents the Site description and operational history, and summarizes the environmental setting.
- **Section 3.0 – Data Summary:** Presents existing Site characterization data, and describes the data usability requirements for environmental data that will be used in the SLERA for

The sludge from aeration lagoon #3A was applied to the LTU in September of 1994. Before November 8, 1990, the LTU ceased accepting hazardous waste because of the Land Disposal Regulation. The LTU continued to accepting non-hazardous waste as allowed under the delay of closure rule until 1997. The LTU is vertically divided into the zone of waste incorporation from zero to 10 inches below ground surface (bgs), a treatment zone from 10 inches to a maximum of 4.5 feet bgs, and the area below the treatment zone.

2.1.2.6 Former Tank Farm

The FTF consisted of 23 large storage tanks that were used to store crude oil, intermediate, and finished products, and encompasses most of the Site south of the PA. The tank farm is designated SWMU 52.

2.1.3 Surface Water Features

On-Site surface water exists in two primary impoundment types: active treatment ponds that comprise the final stages of the groundwater treatment system, and seasonally wet stormwater retention basins. These impoundments are described below and shown on Figure 1-2; however, potential ecological exposures associated with ponds in the active treatment system will not be quantified in the SLERA.

Off-Site surface water exists primarily in the Arkansas and Walnut rivers; the relationship between these rivers and the Site, including potential sources of contamination, is described below.

2.1.3.1 Groundwater Treatment System Ponds

In the final stages of the groundwater treatment system, operated under a NPDES permit, water flows from the bioreactor tank to Oxidation Pond No. 1A (SWMU 4), Oxidation Pond No. 1B (SWMU 5), Oxidation Pond 2 (SWMU 6), Oxidation Pond No. 3 (SWMU 7), and finally to Oxidation Pond 4 (SWMU 8) for additional biodegradation of organic compounds before discharge through a NPDES outfall to the Walnut River.

Deleted: ground

2.1.3.2 Evaporation Ponds and Stormwater Pond

Evaporation Ponds No. 1 through No. 3 (SWMU 9, 10, and 11) were constructed from native soil around 1956 to manage stormwater from non-process areas, and are still in use. Water in this system flows from the 375,000 gallon capacity Evaporation Pond No. 1 to the 500,000 gallon capacity Evaporation Pond No. 2 and finally to the 500,000 gallon capacity Evaporation Pond No. 3. The stormwater ponds are six to seven feet deep, and 7,000 to 10,000 square feet in surface area.

During the history of the refinery, water in Evaporation Pond No. 1 sometimes contained a sheen, and during the visual site inspection (VSI) staining was observed along the embankment (A.T. Kearney, Inc. and Harding Lawson Associates, 1987). Also during the VSI, a scum layer was observed on the water surface in Evaporation Pond No. 2, and light staining was observed

oxidation ponds, periodic tilling of the soil in the LTU, and occasional environmental work, including monitoring well sampling. Human activity on Site and maintenance practices such as mowing likely limit ecological receptors to species tolerant of disturbed conditions.

Habitat for ecological receptors consists mainly of mown grass and forbs, open surface water in the oxidation ponds, and small stands of deciduous trees and shrubs. As shown in Figure 2-3, the majority of the Site is comprised of disturbed open grassy areas. Site photographs are included in Appendix A of this Work Plan. Plant species include Johnson grass, Bermuda grass, crab grass, buffalo grass, duckweed, hackberry, ash, locust, oak, cottonwood, elm, and cedar. A chain link security fence encloses the Site; however, medium to large terrestrial receptors may access the Site by jumping the fence, or enter the site through the outfall channel discharge pipe through the levee. No systematic surveys have been conducted to record plants and animals at the Site; however, anecdotal information is available from on-Site personnel. Mammals observed on Site include deer, foxes, beavers, muskrats, armadillos, skunks, groundhogs, gophers, rats, and mice. Birds observed on Site include bald and golden eagles, red-tailed hawks, sparrows, pigeons, starlings, seagulls, pelicans, Canada geese, mallard ducks, and white egrets. Turtles, including snapping turtles, have been observed, and the oxidation ponds contain minnows, goldfish, and grass carp, which were planted to eat algae. The stormwater retention ponds are infrequently inundated, and therefore are more likely to provide foraging habitat and occasionally drinking water for terrestrial receptors, rather than providing habitat for upper trophic level aquatic-dependent receptors. The seasonally inundated stormwater ponds likely provide habitat for invertebrates (including meiofauna) during the wet season. The burrows of beavers have been observed in the Oxidation Pond dikes, and, although potentially limited due to historic compaction, burrows of other animals likely occur in other areas of the Site.

Animals with small home ranges, such as mice, are potentially exposed to Site media for their entire lives. Other animals probably spend the majority of their time in more suitable habitat adjacent to the Site, or are only in the area seasonally. Threatened and endangered species are not expected to utilize the Site, as adjacent habitat is more suitable. Therefore, the ecological effects evaluation will be based on protection of populations of ecological receptors, rather than individual organisms.

4.1.3 Selection of Assessment and Measurement Endpoints

Assessment endpoints focus the ecological risk assessment on the guilds or communities that might be adversely affected by exposure to a COPEC. As defined in USEPA's Guidelines for Ecological Risk Assessment (USEPA, 1998), an assessment endpoint is an explicit expression of the environmental value that is to be protected (for example, growth, survival, and reproduction of a specific species population). A measurement endpoint is defined as a quantitative expression of an observed or measured effect of the hazard; that is, a measurable response to a stressor related to the ecological characteristic chosen as the assessment endpoint (USEPA, 1998). As described above, the Site provides habitat for ruderal plant communities, terrestrial avian and mammalian species, including burrowing mammals, and aquatic-dependent avian and mammalian species. On-Site oxidation ponds are not meant to provide habitat, and fish are present only for the purpose of eating nuisance plants and invertebrates; additionally, exposures of aquatic dependent avian and mammalian species associated with the oxidation ponds will be

concentrations in ambient air are not expected to be high, given the vegetative cover and low Site activity. Concentrations of volatile constituents in both above ground and burrow air are not expected to be high because concentrations of these constituents in soil and groundwater are low to non-detect.

Exposure pathways for on-Site surface water are conservatively considered to be potentially complete and significant for terrestrial receptors using surface water in detention ponds as a drinking water source, and aquatic dependent species foraging, resting in, or otherwise utilizing detention ponds. Because on-Site stormwater detention ponds are dry a significant portion of the year, terrestrial receptors may also be exposed to dry sediment in the detention ponds, and through direct contact or uptake to prey items, during summer months. Additionally, the ponds may contain meiofauna (e.g., ostracods, copepods, cladocerans) when inundated.

Deleted: due to the seasonality of the stormwater detention ponds, although water column invertebrates, benthic invertebrates, and aquatic plants may be present seasonally, the ponds are not expected to contain water long enough to support a full life cycle of these receptors

Exposure pathways for off-Site surface water, including direct contact and uptake to prey, are potentially complete and significant for all aquatic and aquatic dependent receptors.

4.2 ECOLOGICAL EFFECTS EVALUATION

4.2.1 Screening Benchmarks

Ecological screening benchmarks will be derived from the sources listed below, in addition to other peer review literature, as necessary. For each chemical, the medium-specific screening benchmark selected for the ecological effects evaluation will be the lowest available for any receptor from the sources listed.

Soil

- USEPA Ecological Soil Screening Levels (EcoSSLs) (USEPA, various dates)
- Oak Ridge National Laboratory's (ORNL's) Toxicological Benchmarks for plants and terrestrial invertebrates (ORNL1997a; 1997b)
- ORNL (ORNL, 1996a, b)
- Primary and secondary literature sources

Surface Water

- National Ambient Water Quality Criteria (USEPA, 2009)
- Kansas Water Quality Criteria (KDHE, 2008)
- Region 5 Ecological Screening Levels (USEPA, 2003)
- ORNL toxicological benchmarks for aquatic biota (ORNL, 1996a, b)
- Primary and secondary literature sources

Sediment

- MacDonald, D.D., C.O. Ingersoll, and T. Berger (2000) Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems

Screening-Level Ecological Risk Assessment Work Plan for Soil, Surface Water, and Sediment

Former Total Petroleum Refinery
Arkansas City, Kansas

PREPARED FOR:

**MRP Properties Company, LLC.
1400 South M Street
Arkansas City, Kansas 67005**

PREPARED BY:



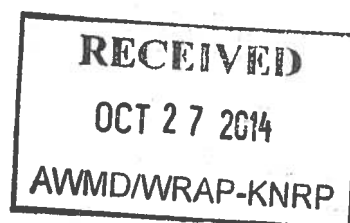
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DATE:

AUGUST 22, 2014
REVISED OCTOBER 24, 2014





MWH

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Chief of the Hazardous Waste Permits Section
Kansas Department of Health and Environment
Bureau of Waste Management
ATTN: Mostafa Kamal, P.E., CHMM
1000 SW Jackson, Suite 320
Topeka, Kansas 66612-1366

U.S. Environmental Protection Agency, Region 7
Air and Waste Management Division
RCRA Corrective Action & Permits Branch
ATTN: Brad Roberts, P.G.
11201 Renner Boulevard
Lenexa, Kansas 66219

**Re: Screening Level Ecological Risk Assessment Work Plan
MRP Properties Company, LLC – Arkansas City, Kansas
EPA ID No. KSD087418695
VIA FEDERAL EXPRESS TRK#'s: 7709 2202 6601 / 7709 2203 8454**

Dear Mr. Kamal and Mr. Roberts:

MWH Americas, Inc. (MWH) is transmitting this work plan for the screening level ecological risk assessment at the Arkansas City, Kansas site on behalf of MRP Properties Company, LLC (MRP). This work plan has been prepared in accordance with the KDHE and EPA comments from March 31, 2014.

Please contact either Brenda Epperson of MRP at 210-345-4619 or me at 303-291-2262 if you have any questions regarding this work plan.

Sincerely,

MWH Americas, Inc.

Joseph (Jay) Mednick, P.G.
Principal Hydrogeologist

Enclosure: Work Plan

Cc: Brenda Epperson, MRP w/enc.
Kent Biggerstaff, MRP w/enc.
Bruce Narloch, PhD. MWH w/enc.

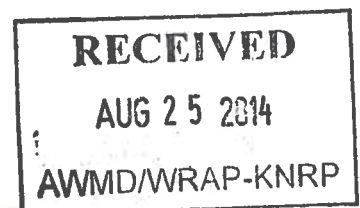


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LIST OF ACRONYMS AND ABBREVIATIONS

AMSL	above mean sea level
AST	aboveground storage tank
bgs	below ground surface
CA	Canadian Fine Silty Loam
CDL	Construction Debris Landfill
CMS	Corrective Measures Study
CSM	conceptual site model
DA	Dale Silt Loam
EU	Exposure Unit
FCC	fluid catalytic cracker
FTF	former Tank Farm
EUSSI	Exposure Unit Supplemental Soil Investigation
HFA	hydrofluoric acid
HHRA	human health risk assessment
HQ	hazard quotient
JSA	Junk Storage Area
KDHE	Kansas Department of Health & Environment
LTU	Land Treatment Unit
MRP	MRP Properties Company, LLC
MDL	method detection limit
MRL	method reporting limit
MWH	MWH Americas, Inc.
NPDES	National Pollutant Discharge Elimination System
PA	Process Area
PAH	polycyclic aromatic hydrocarbon
PID	photoionization detector
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SLERA	Screening Level Ecological Risk Assessment
SVOC	semivolatile organic compound
SWMU	solid waste management unit
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
VSI	visual site inspection
Work Plan	SLERA Work Plan

1.0 INTRODUCTION

This screening-level ecological risk assessment (SLERA) work plan for soil, surface water, and sediment (Work Plan) was prepared by MWH Americas, Inc. (MWH) on behalf of MRP Properties Company, LLC (MRP) for the former Total Petroleum Refinery in Arkansas City, Kansas (the Site). Ecological receptors are not exposed to groundwater at the Site. Any impact occurring as a result of groundwater discharge directly to the Walnut River will be evaluated via surface water and sediment sampling results. Consequently, this SLERA does not evaluate groundwater, as further described in Section 3.1. In support of Resource Conservation and Recovery Act (RCRA) Corrective Measures Study (CMS) activities for the Site, MRP submitted a draft Human Health Risk Assessment (HHRA) Work Plan on January 25, 2013, and a Data Gap Investigation (DGI) Work Plan on February 11, 2013, to the Kansas Department of Health & Environment (KDHE) and the U.S. Environmental Protection Agency Region 7 (USEPA). The KDHE and USEPA provided written comments, dated July 19, 2013. Among other comments, the agencies requested that, in addition to the HHRA for soil and groundwater, MRP conduct a baseline HHRA for surface water and sediment, and a SLERA for soil, surface water, and sediment. This Work Plan outlines the methods and assumptions to be used in the preparation of a SLERA for soil, surface water, and sediment at the Site. Methods and assumptions to be used in the baseline HHRA for surface water and sediment were presented in a separate work plan.

1.1 SLERA OVERVIEW

A SLERA consists of the first two steps of the USEPA's eight step ecological risk assessment process, and is used to determine if there is potential for exposure of ecological receptors to site-related contamination, if characterization data are sufficient to evaluate potential ecological exposures, and, finally, whether a baseline risk assessment is necessary. The potential for exposure is evaluated by identifying on- and off-site habitats and ecological receptors which may come in to contact with site-related contaminated media, and describing potential pathways between contaminated media and ecological receptors. The sufficiency and usability of site characterization data is evaluated based on adequacy of sample coverage and accuracy and precision of analytical results, as described in Section 3.2 of this Work Plan. Once site media are sufficiently characterized, maximum detected concentrations of Site contaminants are compared to conservative medium-specific screening benchmarks to determine if a more refined baseline ecological risk assessment is necessary. Because maximum detected concentrations do not represent likely exposure concentrations for most receptors, and because benchmarks are conservative, the SLERA does not provide an accurate representation of site impacts, but instead indicates potential for impacts to ecological receptors (USEPA, 1997).

The following guidance documents, and others cited in the text, were used in the preparation of this SLERA:

- Framework for Ecological Risk Assessment (USEPA 1992a);
- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (USEPA 1997);
- Final Guidelines for Ecological Risk Assessment (USEPA 1998);

- The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments (USEPA 2001).

1.2 SITE BACKGROUND

1.2.1 Site Location and History

MRP is the current owner of the Site, which is located at 1400 South M Street in Arkansas City, Cowley County, Kansas. The Site occupies approximately 267 acres located within parts of Section 31 and 32 of Township 34 South and Range 4 East; and Section 5 of Township 35 South and Range 4 East, near the confluence of the Walnut River and the Arkansas River. The eastern boundary of the Site is approximately ½ mile upstream of the confluence of the two rivers, as shown on Figure 1-1. A U.S. Army Corps of Engineers (USACE) levee system along the Arkansas and Walnut rivers protects Arkansas City and the Site from floods.

The former Total Petroleum Inc. (Total) refinery was constructed in the 1920s, and operational until 1996. Since initial operation in the 1920s, the Site has had several different owners. The Site was purchased by Total in April 1978 and this entity was the last owner to operate the former refinery. Refining operations (alkylation, crude, hydrocracker, reformer, etc.) at the facility were discontinued August 1996. The process units in the main process area and a majority of the tanks associated with the refinery were demolished by 2003. Figure 1-2 contains a plan delineating major areas at the Site. Current Site use consists of a terminal operation where asphalt is transported by truck to the terminal, stored, and then transported by truck to customers. The terminal does not process, mix, or blend asphalt at the Site.

As a result of this long history of refining activity, petroleum is present in the subsurface at the Site. Hydrocarbon recovery from both the saturated and unsaturated zone has been ongoing since the early 1940s. A formal groundwater restoration program (hydrocarbon recovery) was initiated in 1982.

1.2.2 Previous Investigations

The Site is currently regulated under a RCRA post closure care permit with KDHE as the lead agency. A sediment and surface water characterization was conducted in 1989 and 1990 followed by a soil and groundwater investigation in 1990 culminating in the Final RFI Report (RSA, 1992). These investigations addressed soil, groundwater, surface water, and sediment at the Site. Additional delineation was conducted as part of a Phase II RFI investigation in 1999. The results of these investigations are summarized in Section 3 of this Work Plan.

A RCRA Facility Investigation (RFI) Report (completed in August, 1992), a Phase II RFI Report (completed in June, 2000), and USEPA's Environmental Indicator (EI) process determined Groundwater Migration and Current Human Exposures were under control (USEPA, 2000a; 2000b). A Corrective Measures Study (CMS) work plan (completed in February, 2002), and a corrective action objectives document (completed in May, 2005) have been approved by the USEPA (May, 2005). In addition, an Exposure Unit Supplemental Soil Investigation (EUSI) Report was prepared for a portion of the Site and submitted to the agencies in April 2011. An

HHRA work plan for soil and groundwater (MWH, 2014a) and an HHRA work plan for surface water and sediment (MWH, 2014b) were submitted to the agencies on April 28, 2014 and July 18, 2014, respectively, and a soil investigation work plan is in progress.

1.2.3 Future Site Use and Risk Assessment Framework

The Site is currently zoned industrial, and the most likely scenario for future land use at the Site is redevelopment as commercial or industrial properties. Smaller redeveloped properties would likely be almost entirely paved or covered in concrete; however, for the purpose of evaluating ecological exposures in the SLERA, it will be assumed that the most contaminated locations are left unexcavated and uncovered. Terrestrial ecological receptors that forage or live at the Site could utilize any portion of the Site; however, for the purpose of prioritizing areas for potential corrective action, and for consistency with the results of HHRA for soil and groundwater at the Site, the exposure units (EUs) defined in the HHRA Work Plan for Soil and Groundwater (MWH, 2014a) will be used to quantify ecological exposures as well (Figure 2-1).

Under future Site land use, it is likely that the current stormwater detention ponds will remain in use. The evaluation of current potential ecological exposures to media in the stormwater detention ponds are proposed herein and are expected to be protective of any future potential exposures. Use of the active treatment system ponds will most likely continue unchanged until the groundwater protection standards (GWPS) are achieved at the downgradient boundary of the Site. Because the ponds are part of an active treatment system, MRP is not seeking to close these units at this time. Therefore evaluation of ecological exposures to surface water and sediment at these units will be evaluated in a future document.

1.3 PURPOSE AND SCOPE

The purpose of this Work Plan is to describe the methods and assumptions that will be used during the preparation of a SLERA for soil, surface water, and sediment for the Site, including an evaluation of existing data and recommendations regarding additional data requirements. Screening-level ecological hazard estimates associated with impacted soil, surface water, and sediment will be calculated following additional Site characterization to address data gaps for these media.

1.4 ORGANIZATION

This Work Plan consists of five sections, as described below.

- **Section 1.0 – Introduction:** Summarizes the Site background and presents the purpose and scope and organization of this Work Plan.
- **Section 2.0 – Project Setting:** Presents the Site description and operational history, and summarizes the environmental setting.
- **Section 3.0 – Data Summary:** Presents existing Site characterization data, and describes the data usability requirements for environmental data that will be used in the SLERA for

soil, surface water, and sediment.

- **Section 4.0 – Problem Formulation and Effects Evaluation:** Evaluates potential exposure pathways between Site media and ecological receptors; including presence or absence of habitats, receptors and fate and transport of historic contamination. The section also presents the hierarchy for ecological screening values to be used in the SLERA.
- **Section 5.0 – References:** Lists the references cited in this Work Plan

2.0 PROJECT SETTING

A general description of the Site setting is presented in this section.

2.1 FACILITY DESCRIPTION

The Site is located southeast of the incorporated limits of Arkansas City in southwestern Cowley County, Kansas. It occupies approximately 260 acres northwest of the confluence of the Walnut and Arkansas Rivers. Petroleum refining facilities occupied the former Process Area (PA) in the northern portion of the Site, while the former Tank Farm (FTF), Construction Debris Landfill (CDL), Land Treatment Unit (LTU), former Junk Storage Area (JSA), and waste water treatment system occupied the southern portion of the Site (Figure 1-2). Except for facilities associated with the current asphalt terminal operation, refining facilities and infrastructure have been removed. Additionally, former surface water impoundments remain in use for stormwater detention and as the final stages of the groundwater treatment system.

2.1.1 Site Operations, Decommissioning, and Current Use

The former refinery, which was operational from the 1920s until August 1996, produced unleaded gasoline, liquefied petroleum gas (LPG), propylene, fuel oils, jet fuels, and asphalt at a nominal operating capacity of 60,000 barrels per day. The refinery received approximately 85% of its crude oil supply by pipeline and transported approximately 85% of its refined products by pipeline. The remaining product was transported by truck. The integrated refining processes included two crude fractionation units, a hydrofluoric acid (HFA) alkylation unit, two catalytic reformers, gas plant, hydrocracker, propylene splitter, sulfur recovery plant and other supporting facilities.

As a result of the long history of refining activity, petroleum is present in the subsurface in portions of the Site. Hydrocarbon recovery from both the saturated and unsaturated zone has been ongoing at the Facility since the early 1940s. In 1982, Total initiated a formal groundwater restoration program (hydrocarbon recovery) within the main part of the Site. The hydrocarbon recovery program has resulted in the installation of more than 100 groundwater monitoring wells and numerous product recovery wells throughout the Site. Most of the monitoring wells were installed for the purpose of delineating the areal extent and thickness of hydrocarbon in the groundwater beneath the Site. The current groundwater containment system operates as a corrective action requirement of the facility's Hazardous Waste Management Permit and an interim measures hydrocarbon recovery system within the Site to recover free phase hydrocarbon product. Solid waste management units (SWMUs) 4, 5, 6, 7, and 8, also known as Oxidation Ponds 1A, 1B, 2, 3, and 4, respectively, comprise the final legs of this groundwater treatment system.

Current activity at the Site, other than Site maintenance and operation of the groundwater treatment system, consists of an asphalt distribution terminal in the northern portion of the Site. Decommissioning has eliminated most of the structures at the Site including buildings, refinery process units, the tank farm, and underground piping to six feet below ground surface.

2.1.2 Refinery Features

Major features of the former refinery, as shown on Figure 1-2, are described below.

2.1.2.1 Asphalt Terminal

The asphalt distribution terminal is located in the northern portion of the Site. Asphalt is received from off-Site sources via truck and then transported off-Site to customers via truck. Asphalt is not processed, blended, or mixed at the Site. Stormwater from the asphalt operation area is captured in a lift station and is treated in the Oxidation Ponds before discharge to the Walnut River under the facility's National Pollution Discharge Elimination System (NPDES) permit.

2.1.2.2 Process Area

The PA encompasses the former refinery process units, and extends north across the railroad spur toward the Walnut River. The PA includes former process units, and the asphalt unit, and is approximately 46 acres.

2.1.2.3 Junk Storage Area

The JSA, designated SWMU-20, is a flat, open area that covers approximately 5.5 acres. The Junk Storage Area is where equipment was staged prior to being scrapped or reused.

2.1.2.4 Construction Debris Landfill

The CDL, designated Solid Waste Management Unit (SWMU) 47, is a permitted construction demolition landfill that covers approximately 14 acres; only approximately 4 acres have been used for construction demolition material. The Unit started in 1982. The CDL received permit number 523 through the solid waste division of KDHE for operating a solid waste disposal area. The area covered by the CDL includes Oily Lagoon No. 2 (SWMU-14), which covered approximately three acres, and a one acre fluid catalytic cracker (FCC) catalyst disposal area (SWMU-16). The location of the CDL outside the Walnut River and Arkansas River levees reduces the likelihood of future development.

2.1.2.5 Land Treatment Unit

The LTU consists of a 3.85 acre soil plot in the southern half of the Site that was constructed in June 1981 and was historically used to treat refinery wastes. The LTU was permitted to accept hazardous and non-hazardous refinery waste streams. Typical hazardous wastes applied to the LTU include slop oil emulsion solids, heat exchanger bundle cleaning sludge, tank bottoms, API oil-water separator sludge, oily coke deposits, cooling tower sludges, and dissolved air floatation (DAF) sludge. Non-hazardous wastes managed have included items such as activated charcoal, bauxite, mole sieve, attapulgus clay, oily impacted soils, oily coke deposits, and tank bottoms. Alkyl neutralization pit sludge and bottom sludge from the surface impoundments #1 and #2, and the #3A aeration lagoon were also applied to the LTU. Sludge from impoundments #1 and #2 were applied to the LTU during their closure that occurred between August and October of 1987.

The sludge from aeration lagoon #3A was applied to the LTU in September of 1994. Before November 8, 1990, the LTU ceased accepting hazardous waste because of the Land Disposal Regulation. The LTU continued to accepting non-hazardous waste as allowed under the delay of closure rule until 1997. The LTU is vertically divided into the zone of waste incorporation from zero to 10 inches below ground surface (bgs), a treatment zone from 10 inches to a maximum of 4.5 feet bgs, and the area below the treatment zone.

2.1.2.6 Former Tank Farm

The FTF consisted of 23 large storage tanks that were used to store crude oil, intermediate, and finished products, and encompasses most of the Site south of the PA. The tank farm is designated SWMU 52.

2.1.3 Surface Water Features

On-Site surface water exists in two primary impoundment types: active treatment ponds that comprise the final stages of the groundwater treatment system, and seasonally wet stormwater retention basins. These impoundments are described below and shown on Figure 1-2; however, potential ecological exposures associated with ponds in the active treatment system will not be quantified in the SLERA.

Off-Site surface water exists primarily in the Arkansas and Walnut rivers; the relationship between these rivers and the Site, including potential sources of contamination, is described below.

2.1.3.1 Groundwater Treatment System Ponds

In the final stages of the groundwater treatment system, operated under a NPDES permit, water flows from the bioreactor tank, to Oxidation Pond No. 1A (SWMU 4), Oxidation Pond No. 1B (SWMU 5), Oxidation Pond 2 (SWMU 6), Oxidation Pond No. 3 (SWMU 7), and finally to Oxidation Pond 4 (SWMU 8) for additional biodegradation of organic compounds before discharge through a NPDES outfall to the Walnut River.

2.1.3.2 Evaporation Ponds and Stormwater Pond

Evaporation Ponds No. 1 through No. 3 (SWMU 9, 10, and 11) were constructed from native soil around 1956 to manage stormwater from non-process areas, and are still in use. Water in this system flows from the 375,000 gallon capacity Evaporation Pond No. 1 to the 500,000 gallon capacity Evaporation Pond No. 2 and finally to the 500,000 gallon capacity Evaporation Pond No. 3. The stormwater ponds are six to seven feet deep, and 7,000 to 10,000 square feet in surface area.

During the history of the refinery, water in Evaporation Pond No. 1 sometimes contained a sheen, and during the visual site inspection (VSI) staining was observed along the embankment (A.T. Kearney, Inc. and Harding Lawson Associates, 1987). Also during the VSI, a scum layer was observed on the water surface in Evaporation Pond No. 2, and light staining was observed

on the dikes around Evaporation Pond No. 3 (A.T. Kearney, Inc. and Harding Lawson Associates, 1987).

The No. 1 Oil Trap (SWMU 23) was used to manage oily waste water beginning in the 1930s, and later to contain spills and stormwater. There is no documentation of how water and sludge were managed during this use. The No. 1 Oil Trap was removed from service in December 1986. A stormwater pond now occupies the location of the previous No. 1 Oil Trap.

Current stormwater detention ponds contain little to no water during most of the year (personal communication, July 10, 2014)

2.1.3.3 Closed Surface Impoundments

The No. 1 and No. 2 surface impoundments (SWMUs 1 and 2) and the No. 3A aerated lagoon (part of SWMU 3) are closed RCRA-regulated units. These units are currently in RCRA post closure care and do not require further risk assessment.

2.1.3.4 Walnut River

Off-Site surface water includes the Walnut and Arkansas rivers. All stormwater runoff is contained on-Site and only discharged according to NPDES permit requirements. The Arkansas River is upgradient of the Site, and is therefore not likely to have been impacted. Historic seeps reported as a sheen along the Walnut River were observed in the past north of the Site and near the NPDES outfall as shown in Figure 2-2. However, physical barriers preventing potential off-site migration were installed during 1998 and 1999. Currently, groundwater flow to the Walnut River is controlled by the groundwater capture and treatment system; extracted and treated groundwater is discharged to the Walnut River at the NPDES permitted outfall.

NPDES discharge monitoring data for surface water indicate no impacts to the Walnut River. Concentrations of organic and inorganic constituents in Walnut River sediment samples collected in 1990 were low to non-detect. Exposures to sediment impacted by historic discharges is incomplete due to levee realignment work performed between 2002 and 2005 which included expanding the footprint and raising the Walnut River levee adjacent to the Site, and shifting the Walnut River away from the Site to the north and east into formerly dry land that was excavated (Figure 2-2). Therefore, exposure pathways to historic contamination are incomplete for current ecological receptors. Surface water and sediment sampling in the Walnut River will be conducted as described in Section 3.2 to document current conditions and determine if further evaluation is warranted.

2.2 SITE ENVIRONMENTAL SETTING

The majority of the land surrounding the Site is cultivated for wheat and sorghum production. A large flour mill borders the Site to the north, the area to the northwest is residential, a recreational area and the Arkansas City sewage treatment plant lie directly west of the Site, and the Kaw Wildlife Area is located to the south and southeast. The direction of groundwater flow at the Site is to the northeast. Several active oil production wells are located in the vicinity.

Currently, minimal industrial activity associated with the small asphalt terminal occurs at the Site. The Site currently does not contain significant habitat for wildlife, and enhancement for wildlife use is not planned.

2.2.1 Site and Vicinity Land Use

The Site is currently zoned industrial, and land use at the Site is expected to remain industrial or commercial. Land directly to the west is zoned single family residential. The area to the southwest is zoned heavy industrial and is the location of the Arkansas City sewage treatment plant. Land use to the north is limited industrial, including a large flour mill on the northern border. A gravel mining operation is present in industrial land to the south, and the Kaw wildlife management area is located adjacent to the site to the south and southeast.

2.2.2 Geology and Soils

The Site has very little topographic relief and gently slopes towards the northeast. Facility elevations range from approximately 1,078 feet above mean sea level (AMSL), near the southern boundary of the facility, to 1,045 feet AMSL, at the east side of the facility.

The Site is located southeast of Arkansas City in Cowley County, in south central Kansas. Structurally, this area is east of the Nemaha Ridge, and west of the Dexter Anticline. Locally, the facility is located at the confluence of the Arkansas and Walnut Rivers. The region is underlain by Permian-age rocks that dip toward the west (Bayne, 1962). Quaternary alluvium overlies these Permian deposits and is found along major rivers and streams.

The areas along both the Arkansas and Walnut Rivers, including the Site, are underlain by unconsolidated Quaternary-age alluvial deposits. These deposits consist of clay, silt, sand, chert, and limestone gravel (RSA, 1992). The thickness of alluvial deposits in the region is typically less than 25 feet, although recent alluvial deposits along the Arkansas River can be as much as 50 feet in thickness.

The alluvial deposits are underlain by the bedrock of the Permian-age Chase Group which is comprised of interbedded limestone, chert, and shale. The Chase Group has a total thickness of about 350 feet; about half of which is limestone and the other half shale (Bayne, 1962). Bedrock dips to the west, with younger Permian rocks of the Sumner Group regionally overlying the Chase Group. The Chase Group overlies older Permian rocks of the Council Grove and Admire Groups. Progressively older lithologies are exposed at the surface east of the Site.

There are three prominent structures in Cowley County, the Dexter Anticline, the Winfield Anticline, and the Nemaha Anticline. The Dexter Anticline is located in the eastern part of the county and trends northeast-southwest. The east flank has a dip of over 200 feet per mile, while the west flank has a dip of about 100 feet per mile. The Winfield Anticline, which trends northeast-southwest in the central part of the county has a dip less than the Dexter Anticline but can be observed in surface features. The Nehema Anticline extends from central Oklahoma to northeast Kansas, and crosses the northwestern corner of the County. None of these structural features significantly affects the geology at the Site.

According to the United States Department of Agriculture (USDA) Soil Survey of Cowley County (1980), there are four soil types found at the facility; the Canadian Fine Silty Loam (CA), the Dale Silt Loam (DA), the Lincoln-Tivoli Complex and the Verdigris Silt Loam.

The Canadian series (CA) soil is generally deep, well drained, with moderately rapid permeability. This soil type ranges in depth up to about 60 inches and is formed in loamy and sandy alluvium. Slopes of this soil type range from 0 to 1 percent. Canadian series soil is generally located in the southern portion of the Site.

The Dale series (DA) soil type is generally deep, well drained and moderately permeable. Soil depths extend to about 60 inches, and are formed in loamy alluvium. This soil type has slopes of about 0 to 1 percent and trend in an east-west direction in the central portion of the facility.

The Lincoln-Tivoli Complex soil type tends to be a deep soil that is excessively drained with rapid permeability. The depth of this soil type occurs within the upper 60 inches. This soil type is found on floodplain or terrace deposits. Slopes of this soil type range from 0 to 15 percent and are found along the Arkansas and Walnut Rivers at the northeastern and southern boundaries of the facility.

The Verdigris Series soil type is deep and moderately well drained and has moderate permeability. Soil depths extend to about 60 inches and form in silty alluvium. Slopes of this soil type are about 0 to 2 percent and are found on low terraces and floodplains. The Verdigris soil type is located on the northern side of the facility.

2.2.3 Hydrogeology

Groundwater occurs in alluvial and bedrock aquifers in the vicinity of the Site. The alluvial deposits along the Arkansas River Valley provide large quantities of water (500 to 1,000 gallons per minute) which ranges in quality from good to poor. Locally, groundwater from bedrock aquifers can yield large to small quantities of water that ranges from good to poor quality. Chloride concentrations in water wells completed in alluvial sediments at the Site vicinity range from approximately 16 ppm to 650 ppm (Bayne, 1962). Depth to groundwater is impacted by recovery wells, which run 24 hours per day, 7 days per week. The shallowest depth to groundwater recorded at the Site between 1999 and 2013 ranges from less than 10 to more than 20 feet bgs.

Recharge of alluvial aquifers in the region is due mainly to infiltration of precipitation. On an intermittent basis, the Arkansas and Walnut Rivers contribute to alluvial aquifer recharge (Bayne, 1962). During flood conditions, when river water elevations are above the level of the groundwater in the aquifer, movement is in the direction of the aquifer (away from the stream) and aquifer recharge occurs. Regionally, discharge of groundwater usually occurs by flow to streams and rivers, and by evapotranspiration, pumping, and leakage into hydraulically connected aquifers.

2.2.4 Regional Surface Water

The Site is located between the Arkansas and Walnut Rivers upstream of the confluence of the two rivers. The Arkansas River flows southeasterly through Arkansas City then meanders to the northeast where it merges with the south-southeast flowing Walnut River. The two rivers are principal waterways in Cowley County.

Portions of the Site are located within the 100-year flood plain of the Walnut River and the Arkansas River. The maximum peak flow recorded on the Arkansas River is 103,000 cubic feet per second (cfs) on June 10, 1923 and on the Walnut River, the maximum peak flow recorded is 105,000 cfs on April 23, 1944. The maximum peak flow periods of record for the Arkansas and Walnut Rivers are 1903-2013 and 1898-2013, respectively.

Mean daily flows from the Arkansas City gauging station on the Arkansas River and the Walnut River for 1960 through 2010 were obtained from the USGS. For the Arkansas River at Arkansas City (USGS Station 07146500) the mean of the annual maximum mean daily flow was 29,161 cfs. The month when the annual maximum occurred was highly variable from year to year, generally occurring from March through June, or from September through November. The mean of the annual minimum mean daily flow at this station and for this period was 317 cfs. The month when the annual minimum occurred was generally either January or from August through October.

For the Walnut River at Winfield (USGS Station 07147800) the mean of the annual maximum mean daily flow for this period was 24,088 cfs. The month when the annual maximum occurred was again highly variable but most often from April through June, or in November. The mean of the annual minimum mean daily flow for the Walnut River at Winfield for this period was 56 cfs. The month when the annual minimum occurred was most often August, September, or October.

2.2.5 Climate

According to U.S. Army Corps of Engineers (USACE), December 1984, the climate of Cowley County, Kansas is normal for middle latitude, interior continental areas. It is characterized by large variations in annual and daily temperatures, long, hot summers and cold, short winters. The average daily temperature in the winter is 36.6°F. The recorded high and low temperatures for Cowley County are 118°F on August 12, 1936 and -27°F on February 13, 1905, respectively.

Long-term precipitation data are currently available for the 1971-2000 30-year climate normals period. Precipitation in Cowley County is highest during the spring and summer (April-September). Seventy-two percent of the average annual precipitation of 36.7 inches occurs during late evening or nighttime thunderstorms. Ten to eleven inches of the annual precipitation occurs as snowfall.

Occasionally, tornadoes and severe thunderstorms occur within Cowley County. Storms are usually localized in extent and are of short duration. Crop damage by hail is not as extensive in Cowley County as in areas further west.

The closest location recording data on wind speed and direction is Wichita, Kansas. The wind rose (MWH, 2011) for Wichita, Kansas (2000-2009) indicates that the prevailing wind is from the south at an annual mean speed of 13 mph. The secondary prevailing wind direction is from the north.

The average evaporation from March to November for the closest station (Elk City Lake Station, located approximately 55 miles east-northeast of the facility) was 51 inches per year, based on data from 1960 to 1992 (available period of record). No evaporation data is recorded for Arkansas City, Kansas.

2.2.6 Biological Resources

As shown in Figure 2-3, the majority of the Site is comprised of disturbed open grassy areas. The Site is bordered to the west by a residential area consisting of single family houses on quarter acre or larger lots and the Arkansas City wastewater treatment plant. Habitat in these areas is comprised of a mix of open grassy areas and deciduous trees and shrubs (Figure 2-3). These areas likely support wildlife, including small terrestrial species such as raccoon and deer mouse, and provide a corridor for larger terrestrial species such as white tailed deer. To the southwest of the Site is mostly forested open space, and to the southeast is the Kaw Wildlife Area (Figure 2-4). The portion of the Kaw Wildlife Area that borders the Site is approximately 150 acres of mixed open grassland and riparian forest; the entire Kaw Wildlife Area corridor that lies within Kansas is 4,341 acres of land and water in the Arkansas River floodplain. The wildlife area is managed for recreational hunting and fishing. In addition to grassland and riparian forest cover, there is approximately 20-25 acres of wetland in the Wildlife Area. The most popular game species are white-tailed deer, waterfowl, turkey, dove, bobwhite quail, fox squirrel and cottontail rabbit (KDWPT, 2013). Common regional non-game mammal species include coyote, fox, skunk, raccoon, bats, opossum, beaver, and various species of voles, mice, and squirrels. Non-game avian species include bald eagle, great blue heron, killdeer, American robin, and house sparrow. Several species of amphibians and reptiles are also known to have been found within Cowley County. Mammalian, avian, amphibian, and reptilian species known to occur or potentially occurring in Cowley County are listed in Table 2-1.

Federal or State listed threatened and endangered species in Cowley County include the Arkansas darter, Arkansas River shiner, Arkansas River speckled chub, and silver chub. In addition Cowley County is within the known historic range of the eastern spotted skunk, eskimo curlew, least tern, piping plover, snowy plover, Topeka shiner, and whooping crane, and within the probable historic range of the American burying beetle (KDWPT, 2014) (Table 2-2). Additional special status species for the State of Kansas are presented in Table 2-2; other common species occurring or potentially occurring in Cowley County are presented in Table 2-1.

3.0 DATA SUMMARY AND EVALUATION

A summary of the available soil, surface water, and sediment characterization data for the Site is presented in Section 3.1, and recommendations for additional data collection are presented in Section 3.2.

3.1 DATA SUMMARY

The 1990 RFI for the Site was conducted to address potential contamination in soil, groundwater, surface water, and sediment (RSA, 1992). Additional delineation was conducted during the Phase II RFI in 1999 (Earth Tech, 2000), the EUSSI in 2010 (MWH, 2012), annual monitoring at the LTU from 1999 to 2004, and RCRA Permit semiannual groundwater monitoring. Soil, surface water, and sediment data from these previous investigations are described below. Figure 3-1 indicates the locations of existing data for soil and surface water. Ecological receptors are not exposed to untreated groundwater at the Site; exposures to treated groundwater discharged at the NPDES permitted outfall are not expected to result in impacts. Any impact occurring as a result of groundwater discharge directly to the Walnut River will be evaluated via surface water and sediment sampling results. Additionally, although burrowing animals may be exposed to constituents in groundwater that volatilize to burrow air, concentrations of volatile constituents in groundwater are low to non-detect and this pathway is deemed to be insignificant (refer to Section 4.1.4). Therefore, groundwater data are not described here; for groundwater data, see the HHRA WP for Soil and Groundwater (MWH, 2014a).

3.1.1 Soil

The current soil characterization dataset for the Site is not adequate for evaluation of potential ecological exposures due to under-representation or no data from some locations and depths, limited analyte lists for some sampling events, and elevated reporting limits for some analytes. These data limitations, and proposed data gap sampling, are described in the Soil Investigation Work Plan (currently in preparation).

In summary, soil data from the 1990 RFI data are excluded from the data summary due to limited documentation regarding quality control, and lack of precise borehole locations for SWMU samples. These 1990 RFI samples were analyzed for a limited suite of constituents, and excluding them from the SLERA is not expected to be a significant source of uncertainty, given the planned data gap characterization for the Site. Additionally, refinery decommissioning and removal of underground piping resulted in the movement of some of the PA soils that were sampled during the 1990 RFI and the 1999 Phase II RFI. Although the analytical results for these reworked soils represent Site concentrations, the corresponding sample location (i.e., spatial) information is no longer valid. As a result, the 1999 data corresponding to the reworked portions of the PA are not suitable for use in modeling exposures for individual EUs and, therefore will not be used in the SLERA for the Site. Results from the 2010 EUSSI for the PA, JSA, and CDL will be used to evaluate ecological exposures.

3.1.2 Surface Water

Surface water data collected during the 1990 RFI include one sample each from SWMUs 9 and 11, and river locations upstream of the Site, near the NPDES outfall, and at the downstream corner of the Site (Figure 2-2). Samples from the Evaporation Ponds in 1990 were submitted for a limited analytical suite; detected chemicals include ethylbenzene, toluene, and xylenes in Evaporation Pond No. 1 and chromium and lead in Evaporation Pond No. 3. Compounds detected in samples collected from the Walnut River in 1990 at upstream, outfall, and downstream locations include several metals and volatile organic compounds (VOCs), including BTEX.

Surface water sampling during the Phase II RFI was limited to off-Site samples collected from the Walnut River upstream of the Site (SW-1), at the NPDES outfall (SW-2), and downstream (SW-3) at the eastern corner of the CDL (Figure 2-2). Metals and cyanide were detected in samples from upstream of the Site, at the outfall, and at the downstream corner of the Site. One VOC, chloroform, was detected in one sample from the upstream location, and two additional VOCs, 2-butanone and trichloroethene were detected in two different samples from the downstream location.

Existing surface water sampling results for the Site are presented in the HHRA Work Plan for Surface Water and Sediment (MWH, 2014b).

3.1.3 Sediment

Sediment samples collected during the 1989 sediment characterization investigation include discrete and composite sediment samples from SWMUs 9, 10, and 11 and sediment samples from the Walnut River upstream of the Site, at the NPDES outfall, and downstream of the Site. Sediment samples collected from the Evaporation Ponds No. 1 through No. 3 in 1990 were submitted for a limited suite of analyses, including chromium, lead, BTEX, and several polycyclic aromatic hydrocarbons (PAHs). All of these analytes were detected in at least one Evaporation Pond. Barium, chromium, lead, di-n-butylphthalate, and xylenes were detected at all three river sample locations in 1989; benzene and xylene were detected at the sample location near the outfall, and chlorobenzene, ethylbenzene, and xylene were detected at the upstream sample location. Detection limits for some organic compounds were elevated in these 1989 and 1990 data.

During the Phase II RFI, three samples were collected from the top six inches of sediment in each of SWMUs 9, 10, and 11. Each sample was submitted for VOC and semivolatile organic compounds (SVOC) analyses based on field screening with an organic vapor analyzer. The sample with the highest field screening photoionization detector (PID) result was selected for analysis. The sample submitted for metals analysis was a composite of three discrete samples from within each SWMU. Detected analytes include metals, VOCs, and SVOCs, including PAHs. Walnut River sediment sampling was not included in the Phase II RFI.

Existing sediment sampling results for the Site are presented in the HHRA Work Plan for Surface Water and Sediment (MWH, 2014b).

3.2 DATA EVALUATION / DATA GAP RECOMMENDATIONS

Minimum criteria for analytical results to be usable for risk assessment are presented in EPA (1992b). These include requirements for complete data reporting (i.e., sample location, field data and meteorological data), and complete data documentation (i.e., chain of custody records, standard operating procedures, and field notes). The sample collection, preparation, and analytical methods should appropriately identify the constituent form or species; and the specified sample detection limit should be at or below a concentration that is associated with toxicologically relevant levels (e.g., published risk-based screening levels or action levels). Non-detect results with reporting limits greater than the toxicologically relevant levels are not suitable for risk assessment; the significance of any analytical detection limits greater than such criteria will be evaluated on a case-by-case basis and will be described in the Uncertainty Analysis section of the SLERA Report for soil, surface water, and sediment at the Site. EPA (1992b) further requires that data quality indicators be included in the sampling plan at a level sufficient to determine data usability. Only data collected and analyzed at a quality control (QC) level equivalent to USEPA Level III or higher (USEPA, 1988), meets appropriate usability criteria for evaluation in a quantitative risk assessment. USEPA Level III data provide the following:

- Low detection limits
- A wide range of calibrated analyses
- Matrix recovery information
- Laboratory process control information
- Known precision and accuracy

In addition to the data quality objectives listed above, it is necessary to obtain a sufficient quantity of data to estimate potential exposure concentrations. The number of samples required to adequately characterize an exposure area depends on the size of the area and the heterogeneity of the media and potential contamination. The usability of the existing soil, surface water, and sediment data for the Site, and requirements for additional data, are described briefly below.

3.2.1 Soil

Previous soil investigations for the Site have not been designed to provide adequate characterization for all of the EUs to be evaluated in the SLERA; limitations of the current data set include low sample density or uncharacterized areas, limited analyte list for some sample locations, and elevated reporting limits for some analytes. Additional soil sampling will be conducted to fill these data gaps as described in the Soil Investigation Work Plan for the Site (currently in preparation).

3.2.2 Surface Water

Evaporation Ponds 1, 2, and 3 (SWMUs 9, 10, and 11) and Stormwater Pond (SWMU 23)

Surface water sampling data for the evaporation ponds and the stormwater pond are only available for a limited analytical suite and for one sample each from SWMUs 9 and 11, and these data are more than 20 years old. Therefore, surface water in SWMUs 9, 10, 11, and 23 should be sampled. The stormwater ponds are dry most of the year, so sampling will likely need to occur in

the spring or winter. Total surface area for the ponds is between 7,500 and 10,000 square feet, however, surface area of the actual water in the ponds may be less. A minimum of one location will be sampled at two to three depths (i.e., surface, midway in the water column, and bottom of the pond), depending on the depth of the pond. Samples will be analyzed for metals, VOCs, and SVOCs. Details of the sample locations, sampling procedures and analytical methods will be described in the Surface Water and Sediment Investigation Work Plan (currently in preparation).

Walnut River

Surface water samples were collected from three locations in the 1990 Surface Water and Sediment Characterization and the 1999 Phase II RFI; upstream of the Site, at the NPDES outfall and at the downstream corner of the Site. Sampling results from both 1989 and 1999 did not indicate that potential contaminants were present at higher concentrations at the NPDES outfall or down gradient of the Site, compared with upgradient sample results. Additionally, attributing detected concentrations of analytes in surface water in the Walnut River, even during low flow conditions, to historic sediment impacts associated with the Site will be difficult. At the request of the Agencies, however, surface water samples will be collected from the Walnut River. Surface water samples will be collected upstream of the Site, near the NPDES outfall, and downstream of the Site. The surface water samples should be analyzed for metals, VOCs and SVOCs. Details of the sample locations, sampling procedures and analytical methods will be described in the Surface Water and Sediment Investigation Work Plan (currently in preparation).

3.2.3 Sediment

Evaporation Ponds 1, 2, and 3 (SWMUs 9, 10, and 11) and Stormwater Pond (SWMU 23)

Sediment data are only available for a few locations from each pond; the data for SWMU 23 consists of the shallow soil results from a soil boring presented in the 1992 Final RFI Report. Therefore, sediment sampling is recommended for all ponds. Composite samples will be collected according to guidelines for ponds 10,000 square feet and under from KDHE (1996). Three composite samples will be collected: one composite will include discrete samples from the zero to two feet bgs depth range from each of the four quadrants in the pond bottom, one composite sample will include four discrete samples from the pond sides, and one composite sample will include discrete samples from the pond inlets and outlets. Samples will be analyzed for metals, VOCs, and SVOCs. Details of the sample locations, sampling handling procedures, including sample compositing and selection of a representative sample for VOC analysis, and analytical methods will be described in the Surface Water and Sediment Investigation Work Plan (currently in preparation).

Walnut River

Off-Site sediment data from locations upstream, at the NPDES outfall, and downstream of the Site are available from 1989 only. These sample results include few detections and no clear pattern to indicate Site-related impacts. Additionally, access to sediment at the location of historically observed hydrocarbon seeps are no longer available due to river realignment and raising of the levee by the USACE. In 1995, 1998, and 1999 remedial measures were implemented in the areas where hydrocarbon seeps were observed. These remedial measures

were implemented before the USACE river realignment and levee improvements. These remedies subsequently stopped the hydrocarbon seeps.

To verify the current river sediment quality, sediment samples will be collected from the Walnut River upstream of the Site, at the NPDES outfall, and downstream of the site. The sediment samples should be analyzed for metals, VOCs and SVOCs. Details of the sample locations, sampling procedures and analytical methods will be described in the Surface Water and Sediment Investigation Work Plan (currently in preparation).

4.0 PROBLEM FORMULATION AND EFFECTS EVALUATION

As described previously, the SLERA consists of the first two steps of the EPA's eight step ecological risk assessment process, and is used to determine if there is potential for risk, if there is sufficient characterization data to evaluate exposure, and, finally, whether a baseline risk assessment is necessary. The potential for impacts to ecological receptors is described in Section 4.1 by summarizing sources of contamination and transport pathways and environmental fate, describing on- and off-Site ecological habitat, and listing potentially exposed ecological receptors, including threatened and endangered species. This information is depicted graphically in the conceptual site model (CSM) for the Site. Current Site characterization data are not sufficient to evaluate ecological effects, as described in Section 3. Therefore, the screening-level effects evaluation based on ecological benchmarks as described in Section 4.2 will not be evaluated until additional characterization work is complete.

4.1 PROBLEM FORMULATION

The screening-level problem formulation establishes the context for the SLERA results through the development of an ecological CSM. The ecological CSM for the Site incorporates the information on historic and current operations, Site and vicinity land use, and environmental setting described previously, and ecological habitats and potential receptors, described below, to identify complete exposure pathways between Site-related contamination and ecological receptors. The ecological CSM for the Site is presented graphically in Figure 4-1.

4.1.1 Contamination Sources and Transport Pathways

Impacted media at the Site include surface and subsurface soil, groundwater, surface water and sediment. Sources of contamination at the Site include contamination from historic spills and leaks from ASTs, process equipment, and SWMUs in the Process Area, from decommissioned equipment in the Junk Storage Area, releases from SWMUs in the Construction Debris Landfill, and releases associated with tanks and SWMUs in the Former Tank Farm. Contaminants in soil may have been transported by overland runoff to stormwater retention basins, and may have percolated over time to the water table. Additional transport pathways for Site media include soil transport to surface water bodies as windblown dust, groundwater discharge to surface water, and discharge of treated groundwater in to active on-Site treatment ponds and eventually the Walnut River.

4.1.2 Ecological Habitats and Potential Receptors

The Site has been operated as an industrial facility since the early 1900's. Although most refinery infrastructure has been removed and limited activity currently occurs on the Property, no intentional revegetation or restoration has occurred with the exception of the former process area. The Site is characterized primarily by ruderal habitat with limited areas that were revegetated during regulated unit closures. Current use of the property is limited to two office/maintenance buildings and a small asphalt distribution terminal consisting of a loading area and three in service ASTs in the northern portion of the Site. Additional activity includes grounds maintenance, operation and maintenance of the groundwater treatment system including

oxidation ponds, periodic tilling of the soil in the LTU, and occasional environmental work, including monitoring well sampling. Human activity on Site and maintenance practices such as mowing likely limit ecological receptors to species tolerant of disturbed conditions.

Habitat for ecological receptors consists mainly of mown grass and forbs, open surface water in the oxidation ponds, and small stands of deciduous trees and shrubs. As shown in Figure 2-3, the majority of the Site is comprised of disturbed open grassy areas. Site photographs are included in Appendix A of this Work Plan. Plant species include Johnson grass, Bermuda grass, crab grass, buffalo grass, duckweed, hackberry, ash, locust, oak, cottonwood, elm, and cedar. A chain link security fence encloses the Site; however, medium to large terrestrial receptors may access the Site by jumping the fence, or enter the site through the outfall channel discharge pipe through the levee. No systematic surveys have been conducted to record plants and animals at the Site; however, anecdotal information is available from on-Site personnel. Mammals observed on Site include deer, foxes, beavers, muskrats, armadillos, skunks, groundhogs, gophers, rats, and mice. Birds observed on Site include bald and golden eagles, red-tailed hawks, sparrows, pigeons, starlings, seagulls, pelicans, Canada geese, mallard ducks, and white egrets. Turtles, including snapping turtles, have been observed, and the oxidation ponds contain minnows, goldfish, and grass carp, which were planted to eat algae. The stormwater retention ponds are infrequently inundated, and therefore are more likely to provide foraging habitat and occasionally drinking water for terrestrial receptors, rather than providing habitat for upper trophic level aquatic-dependent receptors. The seasonally inundated stormwater ponds likely provide habitat for invertebrates (including meiofauna) during the wet season. The burrows of beavers have been observed in the Oxidation Pond dikes, and, although potentially limited due to historic compaction, burrows of other animals likely occur in other areas of the Site.

Animals with small home ranges, such as mice, are potentially exposed to Site media for their entire lives. Other animals probably spend the majority of their time in more suitable habitat adjacent to the Site, or are only in the area seasonally. Threatened and endangered species are not expected to utilize the Site, as adjacent habitat is more suitable. Therefore, the ecological effects evaluation will be based on protection of populations of ecological receptors, rather than individual organisms.

4.1.3 Selection of Assessment and Measurement Endpoints

Assessment endpoints focus the ecological risk assessment on the guilds or communities that might be adversely affected by exposure to a COPEC. As defined in USEPA's Guidelines for Ecological Risk Assessment (USEPA, 1998), an assessment endpoint is an explicit expression of the environmental value that is to be protected (for example, growth, survival, and reproduction of a specific species population). A measurement endpoint is defined as a quantitative expression of an observed or measured effect of the hazard; that is, a measurable response to a stressor related to the ecological characteristic chosen as the assessment endpoint (USEPA, 1998). As described above, the Site provides habitat for ruderal plant communities, terrestrial avian and mammalian species, including burrowing mammals, and aquatic-dependent avian and mammalian species. On-Site oxidation ponds are not meant to provide habitat, and fish are present only for the purpose of eating nuisance plants and invertebrates; additionally, exposures of aquatic dependent avian and mammalian species associated with the oxidation ponds will be

evaluated at a later time. Ecological receptors in off-Site habitat in the Walnut River include fish and invertebrates in the water column, benthic invertebrates, aquatic plants, aquatic dependent avian species, and aquatic dependent mammals. Assessment endpoints for the Site are:

- protection of terrestrial plants from adverse effects of site-related chemicals on growth and survival;
- protection of terrestrial invertebrates from adverse effects of site-related chemicals on survival;
- protection of terrestrial mammal populations from adverse effects of site related chemicals on growth, survival, and reproduction;
- protection of burrowing mammal populations from adverse effects of site-related chemicals on growth, survival, and reproduction;
- protection of terrestrial avian populations from adverse effects of site related chemicals on growth, survival, and reproduction;
- protection of the water column community from adverse effects of site-related chemicals on survival;
- protection of benthic invertebrates from adverse effects of site-related chemicals on survival;
- protection of aquatic dependent amphibians from adverse effects of site-related chemicals on growth and survival;
- protection of aquatic plants from adverse effects of site-related chemicals on growth and survival;
- protection of aquatic dependent mammal populations from adverse effects of site related chemicals on growth, survival, and reproduction;
- protection of aquatic dependent avian populations from adverse effects of site related chemicals on growth, survival, and reproduction;

The assessment endpoints listed above will be evaluated by comparing the maximum detected concentration of each Site-related chemical to medium-specific benchmarks to calculate screening level hazard quotients. Screening benchmarks are based on levels of growth, survival, and reproduction necessary to sustain populations of ecological receptors. The chemical-specific measurement endpoint is based on the effects recorded in the toxicity test used to derive the selected screening value. Indicator receptors, which are typically individual species, were not identified for this SLERA Work Plan because potential hazard to ecological receptors will be evaluated using media concentrations and screening levels rather than modeled intake doses and toxicity values.

4.1.4 Exposure Pathways for Ecological Receptors

Exposure pathways for ecological receptors are depicted in Figure 4-1. As shown on Figure 4-1, exposure pathways associated with on-Site surface soil, including incidental ingestion and uptake to prey items, are potentially complete and significant for all on-Site terrestrial receptors. Direct contact with on-Site subsurface soil is a potentially complete and significant exposure pathway for on-Site burrowing mammals. Inhalation exposures to soil derived dust and volatile constituents in above ground ambient air, and volatile constituents from subsurface soil and groundwater in burrow air, are potentially complete but insignificant exposure pathways. Dust

concentrations in ambient air are not expected to be high, given the vegetative cover and low Site activity. Concentrations of volatile constituents in both above ground and burrow air are not expected to be high because concentrations of these constituents in soil and groundwater are low to non-detect.

Exposure pathways for on-Site surface water are conservatively considered to be potentially complete and significant for terrestrial receptors using surface water in detention ponds as a drinking water source, and aquatic dependent species foraging, resting in, or otherwise utilizing detention ponds. Because on-Site stormwater detention ponds are dry a significant portion of the year, terrestrial receptors may also be exposed to dry sediment in the detention ponds, and through direct contact or uptake to prey items, during summer months. Additionally, the ponds may contain meiofauna (e.g., ostracods, copepods, cladocerans) when inundated.

Exposure pathways for off-Site surface water, including direct contact and uptake to prey, are potentially complete and significant for all aquatic and aquatic dependent receptors.

4.2 ECOLOGICAL EFFECTS EVALUATION

4.2.1 Screening Benchmarks

Ecological screening benchmarks will be derived from the sources listed below, in addition to other peer review literature, as necessary. For each chemical, the medium-specific screening benchmark selected for the ecological effects evaluation will be the lowest available for any receptor from the sources listed.

Soil

- USEPA Ecological Soil Screening Levels (EcoSSLs) (USEPA, various dates)
- Oak Ridge National Laboratory's (ORNL's) Toxicological Benchmarks for plants and terrestrial invertebrates (ORNL1997a; 1997b)
- ORNL (ORNL, 1996a, b)
- Primary and secondary literature sources

Surface Water

- National Ambient Water Quality Criteria (USEPA, 2009)
- Kansas Water Quality Criteria (KDHE, 2008)
- Region 5 Ecological Screening Levels (USEPA, 2003)
- ORNL toxicological benchmarks for aquatic biota (ORNL, 1996a, b)
- Primary and secondary literature sources

Sediment

- MacDonald, D.D., C.O. Ingersoll, and T. Berger (2000) Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems

- Freshwater sediment screening benchmarks in USEPA's Region 3 Biological Technical Assistance Group (BTAG) (USEPA, 2013)
- Primary and secondary literature sources

4.2.2 Hazard Calculation

The potential for ecological effects associated with exposure to Site-related chemicals will be evaluated by calculating a screening level hazard quotient (HQ):

$$\text{HQ (unitless)} = \frac{\text{Maximum Detected Concentration } (\frac{\text{mg}}{\text{kg}} \text{ or } \frac{\text{mg}}{\text{L}})}{\text{Ecological Screening Benchmark } (\frac{\text{mg}}{\text{kg}} \text{ or } \frac{\text{mg}}{\text{L}})}$$

HQ values exceeding 1.0 indicate the potential for biological or ecological effects on representative receptors. HQ values above 1.0 do not necessarily indicate that a biological or ecological effect will occur, only that a lower threshold has been exceeded (Menzie et al, 1992). In the event that all screening level HQs are less than or equal to 1.0, the site will be proposed for no further evaluation in regard to ecological concerns. In the event that one or more ecological HQs exceed 1.0, the site will be recommended for further evaluation in a baseline ecological risk assessment.

4.3 UNCERTAINTY ANALYSIS

Uncertainties are inherent in the risk assessment process and arise from limitations in the available information, analysis methods, and necessary assumptions. Sources of uncertainty may include chemical characterization information and limitations in the available data and conservatism in screening benchmarks. Sources of uncertainty in SLERA methods, and any additional Site-specific uncertainties, will be described in the SLERA Report for soil, surface water, and sediment.

5.0 REFERENCES

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<http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fwsed/screenbench.htm>

TABLES

Table 2-1
Species Known to Occur or Potentially Occurring in Cowley County
MRP Properties Company, LLC - Arkansas City, Kansas

Species	Source
Mammals	
American Badger (<i>Taxidea taxus</i>)	2
Beaver (<i>Castor canadensis</i>)	2
Big Brown Bat (<i>Eptesicus fuscus</i>)	2
Black-tailed Jackrabbit (<i>Lepus californicus</i>)	2
Black-tailed Prairie Dog (<i>Cynomys ludovicianus</i>)	2
Bobcat (<i>Lynx rufus</i>)	2
Coyote (<i>Canis latrans</i>)	2
Deer Mouse (<i>Peromyscus maniculatus</i>)	2
Eastern Cottontail (<i>Sylvilagus floridanus</i>)	2,3
Eastern Mole (<i>Scalopus aquaticus</i>)	2
Eastern Red Bat (<i>Lasiurus borealis</i>)	2
Eastern spotted skunk (<i>Spilogale putorius</i>)	2
Eastern Woodrat (<i>Neotoma floridana</i>)	2
Elliot's Short-tailed Shrew (<i>Blarina hylophaga</i>)	2
Fox Squirrel (<i>Sciurus niger</i>)	2
Gray Fox (<i>Urocyon cinereoargenteus</i>)	2,4
Hispid Cotton Rat (<i>Sigmodon hispidus</i>)	2
Hispid Pocket Mouse (<i>Chaetodipus hispidus</i>)	2
House Mouse (<i>Mus musculus</i>)	2
Least Shrew (<i>Cryptotis parva</i>)	2
Mink (<i>Neovison vison</i>)	2
Muskrat (<i>Ondatra zibethicus</i>)	2,4
Nine-banded Armadillo (<i>Dasypus novemcinctus</i>)	2
Norway Rat (<i>Rattus norvegicus</i>)	2
Plains Gopher (<i>Geomys bursarius</i>)	2,4
Plains Harvest Mouse (<i>Reithrodontomys montanus</i>)	2
Prairie Vole (<i>Microtus ochrogaster</i>)	2
Raccoon (<i>Procyon lotor</i>)	2
Red Fox (<i>Vulpes vulpes</i>)	2,4
Ringtail (<i>Bassariscus astutus</i>)	2
Striped Skunk (<i>Mephitis mephitis</i>)	2
Texas Mouse (<i>Peromyscus attwateri</i>)	2
Thirteen-lined Ground Squirrel (<i>Ictidomys tridecemlineatus</i>)	2
Tri-colored Bat (<i>Perimyotis subflavus</i>)	2
Virginia Opossum (<i>Didelphis virginiana</i>)	2
Western Harvest Mouse (<i>Reithrodontomys megalotis</i>)	2
White-footed Mouse (<i>Peromyscus leucopus</i>)	2
White-tailed deer (<i>Odocoileus virginianus</i>)	3
Woodchuck (<i>Marmota monax</i>)	2
Woodland Vole (<i>Microtus pinetorum</i>)	2
Birds	
Bobwhite Quail (<i>Colinus virginianus</i>)	3
Canadian Geese (<i>Branta canadensis</i>)	4
Bald Eagle (<i>Haliaeetus leucocephalus</i>), winter	4
Golden Eagle (<i>Aquila chrysaetos</i>), winter	4
Red-tailed Hawk (<i>Buteo jamaicensis</i>), summer	4
Turkey (<i>Meleagris</i>)	3
Mallard (<i>Anas platyrhynchos</i>)	3,4
Amphibians	
American Bullfrog (<i>Lithobates catesbeianus</i>)	1
American Toad (<i>Anaxyrus americanus</i>)	1
Blanchard's Cricket Frog (<i>Acris blanchardi</i>)	1
Boreal Chorus Frog (<i>Pseudacris maculata</i>)	1

Table 2-1
Species Known to Occur or Potentially Occurring in Cowley County
MRP Properties Company, LLC - Arkansas City, Kansas

Species	Source
Common Five-Lined Skink (<i>Plestiodon fasciatus</i>)	1
Gray Treefrog (<i>Hyla chrysoscelis/versicolor</i>)	1
Great Plains Skink (<i>Plestiodon obsoletus</i>)	1
Great Plains Toad (<i>Anaxyrus cognatus</i>)	1
Little Brown Skink (<i>Scincella lateralis</i>)	1
Northern Leopard Frog (<i>Lithobates pipiens</i>)	1
Plains Leopard Frog (<i>Lithobates blairi</i>)	1
Plains Spadefoot (<i>Spea bombifrons</i>)	1
Small-mouthed Salamander (<i>Ambystoma texanum</i>)	1
Southern Leopard Frog (<i>Lithobates sphenoccephalus</i>)	1
Spotted Chorus Frog (<i>Pseudacris clarkii</i>)	1
Western Narrow-mouthed Toad (<i>Gastrophryne olivacea</i>)	1
Western Tiger Salamander (<i>Ambystoma mavortium</i>)	1
Woodhouse's Toad (<i>Anaxyrus woodhousii</i>)	1
Reptiles	
Coachwhip (<i>Coluber flagellum</i>)	1
Common Gartersnake (<i>Thamnophis sirtalis</i>)	1
Common Watersnake (<i>Nerodia sipedon</i>)	1
Copperhead (<i>Agkistrodon contortrix</i>)	1
Dekay's Brownsnake (<i>Storeria dekayi</i>)	1
Diamond-backed Watersnake (<i>Nerodia rhombifer</i>)	1
Eastern Collared Lizard (<i>Crotaphytus collaris</i>)	1
Eastern Hog-nosed Snake (<i>Heterodon platirhinos</i>)	1
Eastern Musk Turtle (<i>Sternotherus odoratus</i>)	1
False Map Turtle (<i>Graptemys pseudogeographica</i>)	1
Flat-headed Snake (<i>Tantilla gracilis</i>)	1
Gophersnake (<i>Pituophis catenifer</i>)	1
Great Plains Rattlesnake (<i>Pantherophis emoryi</i>)	1
Lined Snake (<i>Tropidoclonion lineatum</i>)	1
North American Racer (<i>Coluber constrictor</i>)	1
Ornate Box Turtle (<i>Terrapene ornata</i>)	1
Painted Turtle (<i>Chrysemys picta</i>)	1
Plain-bellied Watersnake (<i>Nerodia erythrogaster</i>)	1
Plains Black-headed Snake (<i>Tantilla nigriceps</i>)	1
Plains Hog-nosed Snake (<i>Heterodon nasicus</i>)	1
Pond Slider (<i>Trachemys scripta</i>)	1
Prairie Lizard (<i>Sceloporus consobrinus</i>)	1
Ring-necked Snake (<i>Diadophis punctatus</i>)	1
Rough Greensnake (<i>Opheodrys aestivus</i>)	1
Six-lined Racerunner (<i>Aspidoscelis sexlineata</i>)	1
Slender Glass Lizard (<i>Ophisaurus attenuatus</i>)	1
River Cooter (<i>Pseudemys concinna</i>)	1
Smooth Softshell (<i>Apalone mutica</i>)	1
Snapping Turtle (<i>Chelydra serpentina</i>)	1
Speckled Kingsnake (<i>Lampropeltis holbrooki</i>)	1
Spiny Softshell (<i>Apalone spinifera</i>)	1
Texas Horned Lizard (<i>Phrynosoma cornutum</i>)	1
Three-toed Box Turtle (<i>Terrapene triunguis</i>)	1
Western Diamond-backed Rattlesnake (<i>Crotalus atrox</i>)	1
Western Groundsnake (<i>Sonora semiannulata</i>)	1
Western Massasauga (<i>Sistrurus tergeminus</i>)	1
Western Milksnake (<i>Lampropeltis gentilis</i>)	1
Western Ratsnake (<i>Pantherophis obsoletus</i>)	1
Western Ribbonsnake (<i>Thamnophis proximus</i>)	1
Western Worm Snake (<i>Carphophis vermis</i>)	1

Table 2-1
Species Known to Occur or Potentially Occurring in Cowley County
MRP Properties Company, LLC - Arkansas City, Kansas

Species	Source
Yellow Mud Turtle (<i>Kinosternon flavescens</i>)	1
Yellow-bellied Kingsnake (<i>Lampropeltis calligaster</i>)	1
Natural Communities	
Ash-Elm-Hackberry Floodplain Forest	5
Cottonwood Floodplain Woodland	5
Cottonwood-Black Willow Floodplain Forest	5
Cottonwood-Sycamore Floodplain Forest	5
Cottonwood-Willow Floodplain Woodland	5
Flint Hills Tallgrass Prairie	5
Freshwater Marsh	5
Mixed Oak Ravine Woodland	5
Neutral Seep	5
Oak Sandstone Glade	5
Post Oak-Blackjack Oak Forest	5
Post Oak-Blackjack Oak Woodland	5
Sandstone Prairie	5
Unglaciaded Tallgrass Prairie	5

Notes:

Sources: 1, 2, 3, 5: KNHI, 2014. 4: Personal Communication with Site Personnel, 2014.

1 - Kansas Herpetological Atlas for Cowley County, found at http://webcat.fhsu.edu/ksfauna/herps/index.asp?page=species&list=county&county_id=1386.

2 - Kansas Mammal Atlas for Cowley County, found at http://webcat.fhsu.edu/ksfauna/mammals/index.asp?page=species&list=county&county_id=1386.

3 - Species noted to be found within the nearby Kaw Wildlife Area (<http://kdwpt.state.ks.us/news/KDWPT-Info/Locations/Wildlife-Areas/Region-4/Kaw>).

4 - Species sightings on Site by Facility personnel per email communication on August 6, 2014. Additional species sightings by Facility personnel, in a general context, are as follows: mosquitos, ants, wasps, sparrows, starlings, pigeons, minnows, pelicans, seagulls, Johnson grass, Bermuda grass, crab grass,

5 - Kansas Biological Survey Maps of Natural Communities found at <http://ksnhi.ku.edu/resources/natural-communities-maps/>.

No Kansas Bird Atlas is currently available online.

Table 2-2
Special Status Species in Cowley County
MRP Properties Company, LLC - Arkansas City, Kansas

Species	State Status	Federal Status	Critical Habitat in Cowley County
Mammals			
Eastern spotted skunk (<i>Spilogale putorius</i>)	Threatened	-	No ^a
Texas Mouse (<i>Peromyscus attwateri</i>)	SINC	-	No
Birds			
Black Tern (<i>Chlidonias niger</i>)	SINC	-	No
Bobolink (<i>Dolichonyx oryzivorus</i>)	SINC	-	No
Brindled Madtom (<i>Noturus miurus</i>)	SINC	-	No
Cerulean Warbler (<i>Dendroica cerulea</i>)	SINC	-	No
Chihuahuan Raven (<i>Corvus cryptoleucus</i>)	SINC	-	No
Curve-billed Thrasher (<i>Toxostoma curvirostre</i>)	SINC	-	No
Eskimo curlew (<i>Numenius borealis</i>)	Endangered	Endangered	No ^a
Ferruginous Hawk (<i>Buteo regalis</i>)	SINC	-	No
Golden Eagle (<i>Aquila chrysaetos</i>)	SINC	-	No
Henslow's Sparrow (<i>Ammodramus henslowii</i>)	SINC	-	No
Least tern (<i>Sterna antillarum</i>)	Endangered	Endangered	No ^a
Long-billed Curlew (<i>Numenius americanus</i>)	SINC	-	No
Piping plover (<i>Charadrius melodus</i>)	Threatened	Threatened	No ^a
Short-eared Owl (<i>Asio flammeus</i>)	SINC	-	No
Snowy plover (<i>Charadrius alexandrinus</i>)	Threatened	-	No ^a
Whip-poor-will (<i>Caprimulgus vociferus</i>)	SINC	-	No
Whooping crane (<i>Grus americana</i>)	Endangered	Endangered	No ^a
Yellow-throated Warbler (<i>Dendroica dominica</i>)	SINC	-	No
Reptiles			
Alligator Snapping Turtle (<i>Macrochelys temminckii</i>)	SINC	-	No
Eastern Hognose Snake (<i>Heterodon platirhinos</i>)	SINC	-	No
Western Hognose Snake (<i>Heterodon nasicus</i>)	SINC	-	No
Fish			
Arkansas darter (<i>Etheostoma cragini</i>)	Threatened	Candidate	Yes
Arkansas River shiner (<i>Notropis girardi</i>)	Endangered	Threatened	Yes
Arkansas River speckled chub (<i>Macrhybopsis tetranema</i>)	Endangered	-	Yes
Bigeye Shiner (<i>Notropis boops</i>)	SINC	-	No
Plains minnow (<i>Hybognathus placitus</i>)	Threatened	-	Yes
River Shiner (<i>Notropis blennioides</i>)	SINC	-	No
Silver chub (<i>Macrhybopsis storeriana</i>)	Endangered	-	Yes
Topeka shiner (<i>Notropis topeka</i>)	Threatened	Endangered	No ^a
Insects			
American burying beetle (<i>Nicrophorus americanus</i>)	Endangered	Endangered	No ^b
Ozark Emerald Dragonfly (<i>Somatochlora ozarkensis</i>)	SINC	-	No
Molluscs			
Creeper Mussel (<i>Strophitus undulatus</i>)	SINC	-	No
Fat Mucket Mussel (<i>Lampsilis siliquoidea</i>)	SINC	-	No
Wabash Pigtoe Mussel (<i>Fusconaia flava</i>)	SINC	-	No
Yellow Sandshell Mussel (<i>Lampsilis teres</i>)	SINC	-	No

Notes:

SINC - state species in need of conservation

Source: KDWPT, 2014

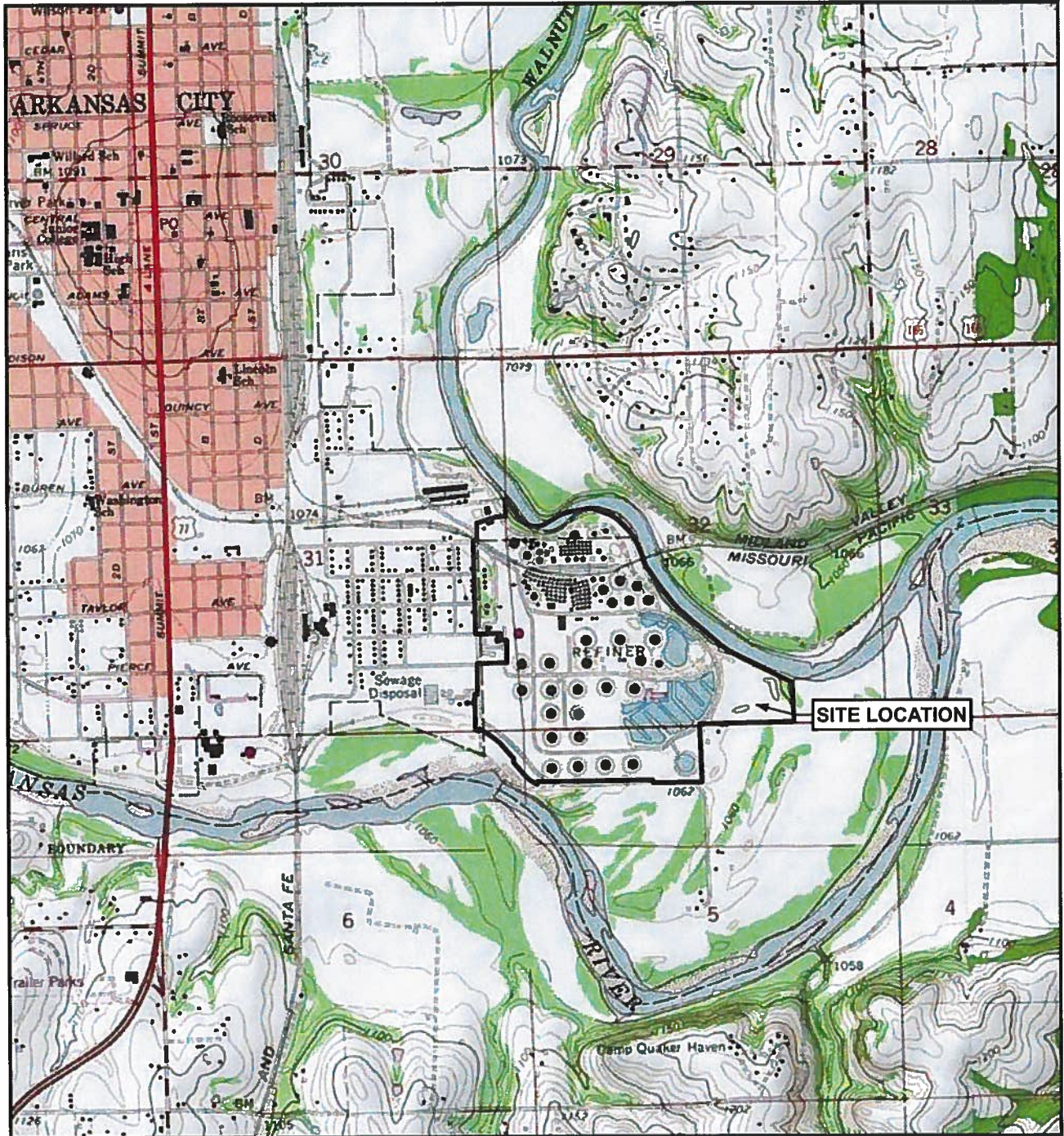
^a Species not currently found in Cowley County, however, the County is within the known historic range.

^b Species not currently found in Cowley County, however, the County is within the probable historic range.

August 22, 2014

FIGURES

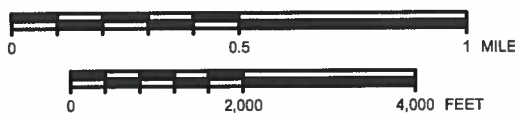
R 4 E



EXPLANATION

SITE BOUNDARIES ARE APPROXIMATE.
 SOURCE: USDA-NRCS-NCGC DIGITAL RASTER GRAPHIC (DRG) MrSID MOSAIC.
 CONTOUR INTERVAL: 10 FEET.
 NATIONAL GEODETIC VERTICAL DATUM OF 1929.
 NORTH AMERICAN HORIZONTAL DATUM OF 1983 (NAD83).
 ARKANSAS CITY, KANSAS. N3700-W9700/7.5. 1965; PHOTOREVISED 1979.
 AMS 6558 II SE-SERIES V878

SCALE 1: 24,000



November 22, 2013

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
11/18/2013	RPH	RPH	JFM

TITLE:

SITE LOCATION MAP

PROJECT:

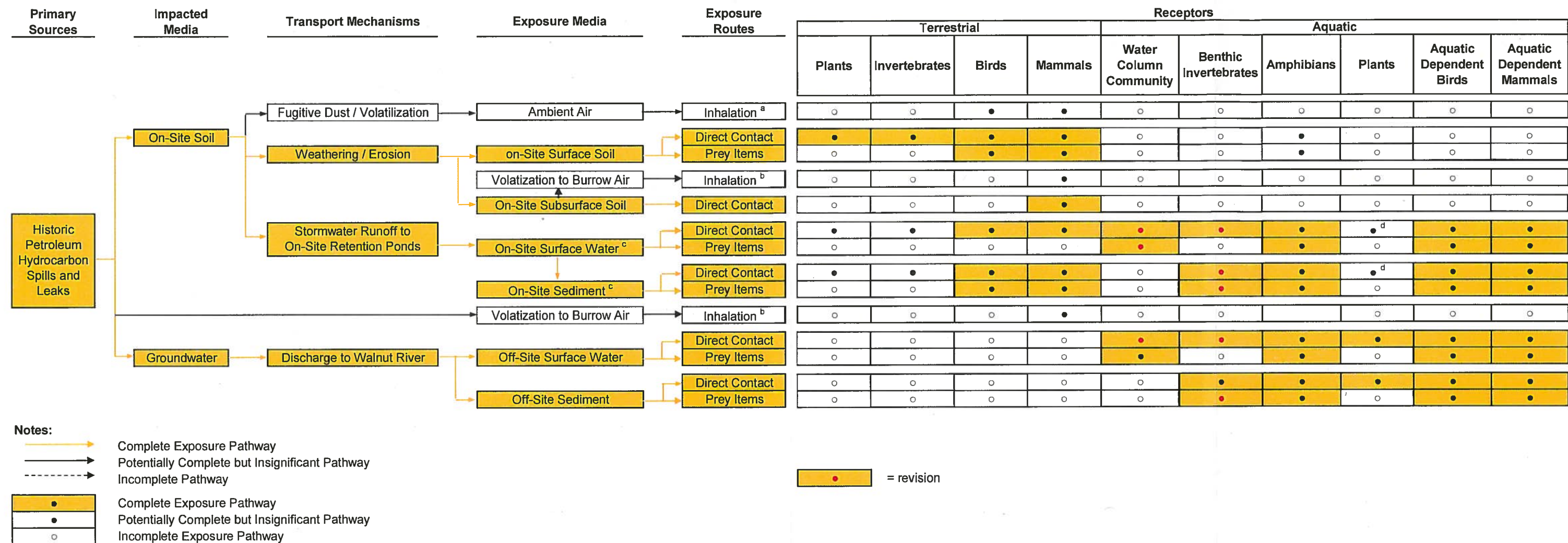
**MRP PROPERTIES COMPANY, LLC
 ARKANSAS CITY, KANSAS**



Figure No.:

1-1

Figure 4-1
Conceptual Site Model for Ecological Receptors
MRP Properties Company, LLC - Arkansas City, Kansas

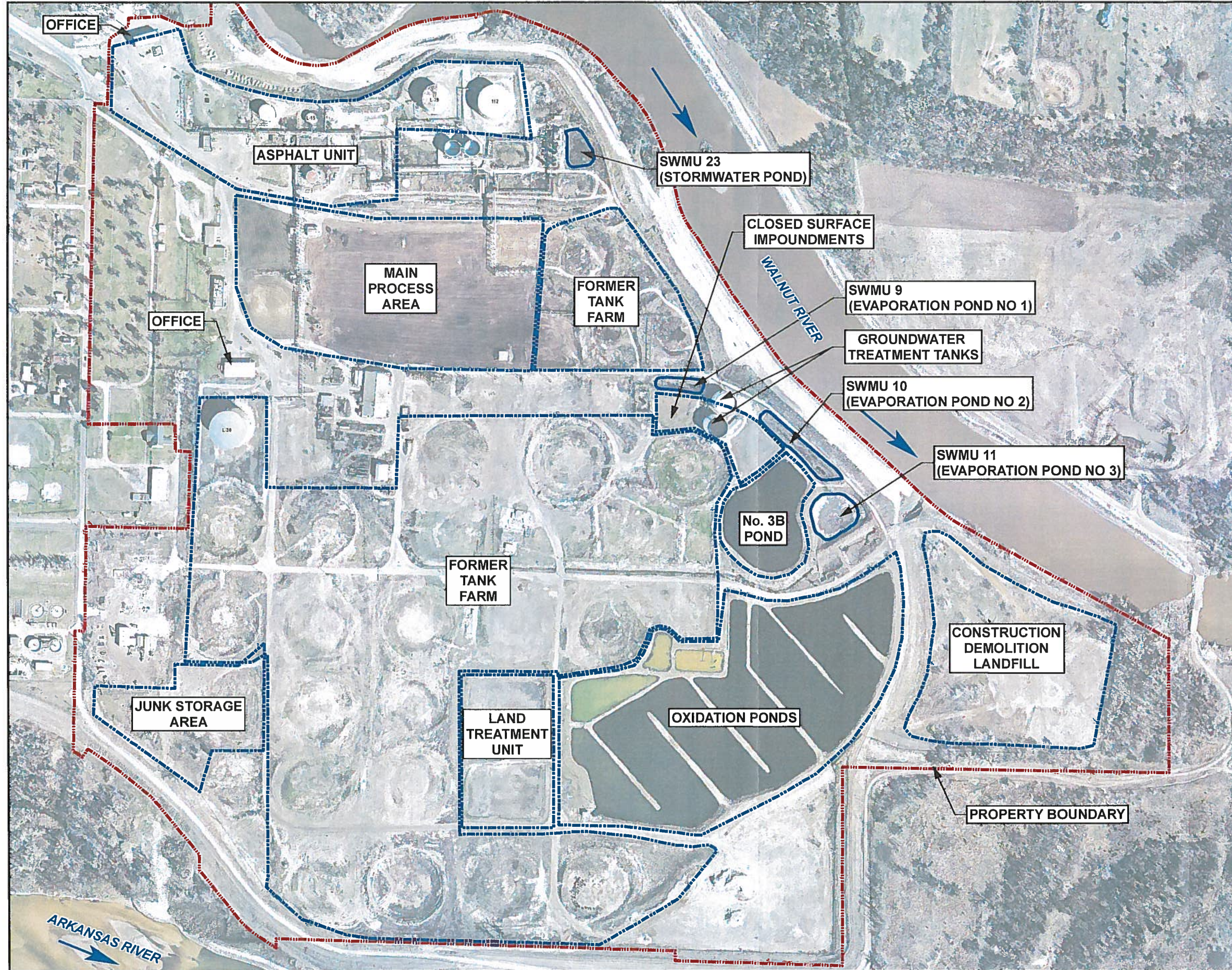


^a The inhalation pathway is minor relative to the incidental ingestion pathway and there is a lack of relevant toxicological information; therefore this pathway was not evaluated quantitatively for ecological receptors.

^b Inhalation of burrow air pathway is complete for burrowing mammals only; this pathway is considered insignificant due to the low concentrations of volatile constituents in soil and groundwater.

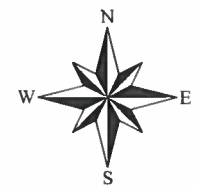
^c Exposure to surface water in storm water retention basins is limited due to the infrequent occurrence of standing water; during dry periods, exposure to dry sediment is similar to exposure to surface soil outside the retention ponds. Exposure associated with surface water in the active treatment ponds operating under a NDPEs permit will not be evaluated at this time.

^d On-Site surface water in stormwater detention ponds is not present for long enough to support aquatic receptors, however, aquatic dependent birds and mammals who primarily utilize year-round water bodies off-Site may contact seasonally present surface water and sediment.

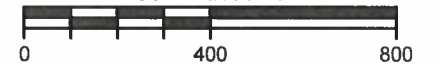


EXPLANATION

--- APPROXIMATE PROPERTY BOUNDARY



SCALE IN FEET



AERIAL PHOTO:
NOVEMBER 22, 2012

REVISION	DATE	DESIGN BY	DRAWN BY	REVIEWED BY
Revision 2	8/13/2014	JFM	CCL	JFM

TITLE:

SITE PLAN

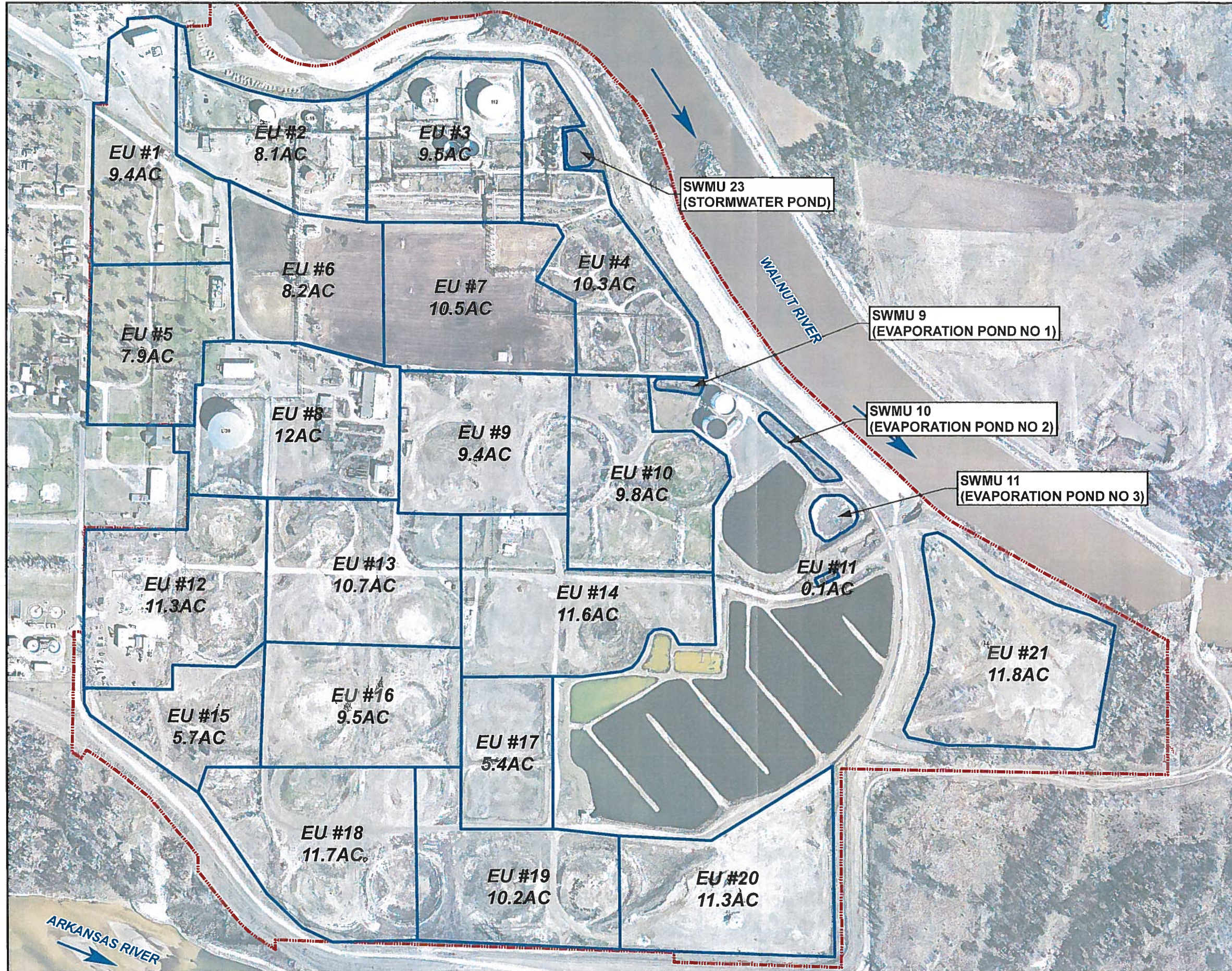
PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS



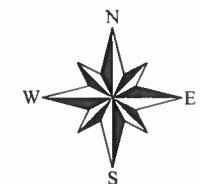
Figure No.:

1-2

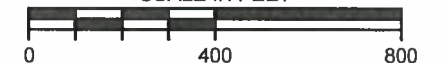


EXPLANATION

--- APPROXIMATE PROPERTY BOUNDARY



SCALE IN FEET



AERIAL PHOTO:
NOVEMBER 22, 2012

REVISION	DATE	DESIGN BY	DRAWN BY	REVIEWED BY
Revision 2	8/20/2014	JFM	SLG	JFM

TITLE:

**SOIL EXPOSURE UNITS
AND SURFACE WATER
SWMUS**

PROJECT:

**MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS**



Figure No.:

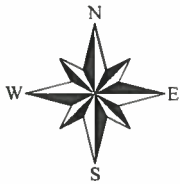
2-1



EXPLANATION

- APPROXIMATE EXTENT OF WALNUT RIVER IN 1999
- DIRECTION OF SURFACE WATER FLOW
- FACILITY PROPERTY BOUNDARY
- APPROXIMATE LOCATION OF 1990 AND 1999 SURFACE WATER SAMPLE LOCATIONS
- LOCATION OF HISTORIC HYDROCARBON SEEPS

NOTE:
APPROXIMATE EXTENT OF WALNUT RIVER IN 1996 TRACED FROM AERIAL IMAGE FOUND IN GOOGLE EARTH, DATED MARCH 19, 1996.



SCALE IN FEET



AERIAL PHOTO:
NOVEMBER 22, 2012

REVISION	DATE	DESIGN BY	DRAWN BY	REVIEWED BY
A	8/20/2014	CCL	CCL	JFM

TITLE:

**WALNUT RIVER HISTORIC
AND CURRENT ALIGNMENT**

PROJECT:

**MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS**



Figure No.:

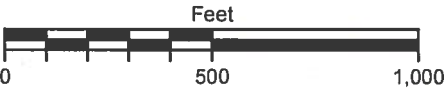
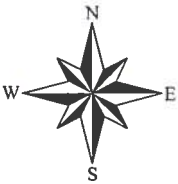
2-2



EXPLANATION

□ SITE PROPERTY BOUNDARY

SOURCE:
AERIAL PHOTO: NATIONAL AGRICULTURE IMAGERY
PROGRAM (NAIP) 2008



DATE	DESIGN BY	DRAWN BY	REVIEWED BY
8/20/2014	JFM	SLG	JFM

TITLE:
2008 AERIAL - ON-SITE HABITAT

PROJECT:
**MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS**



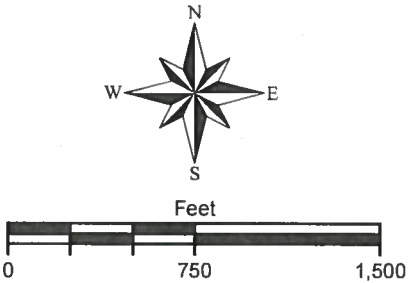
Figure No.:
2-3



EXPLANATION

□ SITE PROPERTY BOUNDARY

SOURCE:
AERIAL PHOTO: NATIONAL AGRICULTURE IMAGERY
PROGRAM (NAIP) 2008



DATE	DESIGN BY	DRAWN BY	REVIEWED BY
8/20/2014	JFM	SLG	JFM

TITLE:
2008 AERIAL - ADJACENT HABITAT

PROJECT:
**MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS**

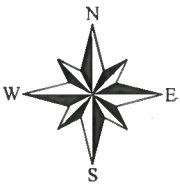


Figure No.:
2-4



EXPLANATION

- 1990 AND 1999 SURFACE WATER SAMPLE LOCATIONS
- 1999 AND 2010 SOIL SAMPLE LOCATIONS
- APPROXIMATE PROPERTY BOUNDARY



SCALE IN FEET



AERIAL PHOTO:
NOVEMBER 22, 2012

REVISION	DATE	DESIGN BY	DRAWN BY	REVIEWED BY
Revision 2	8/20/2014	JFM	SLG	JFM

TITLE:

**HISTORIC SOIL AND SURFACE
WATER SAMPLE LOCATIONS**

PROJECT:

**MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS**



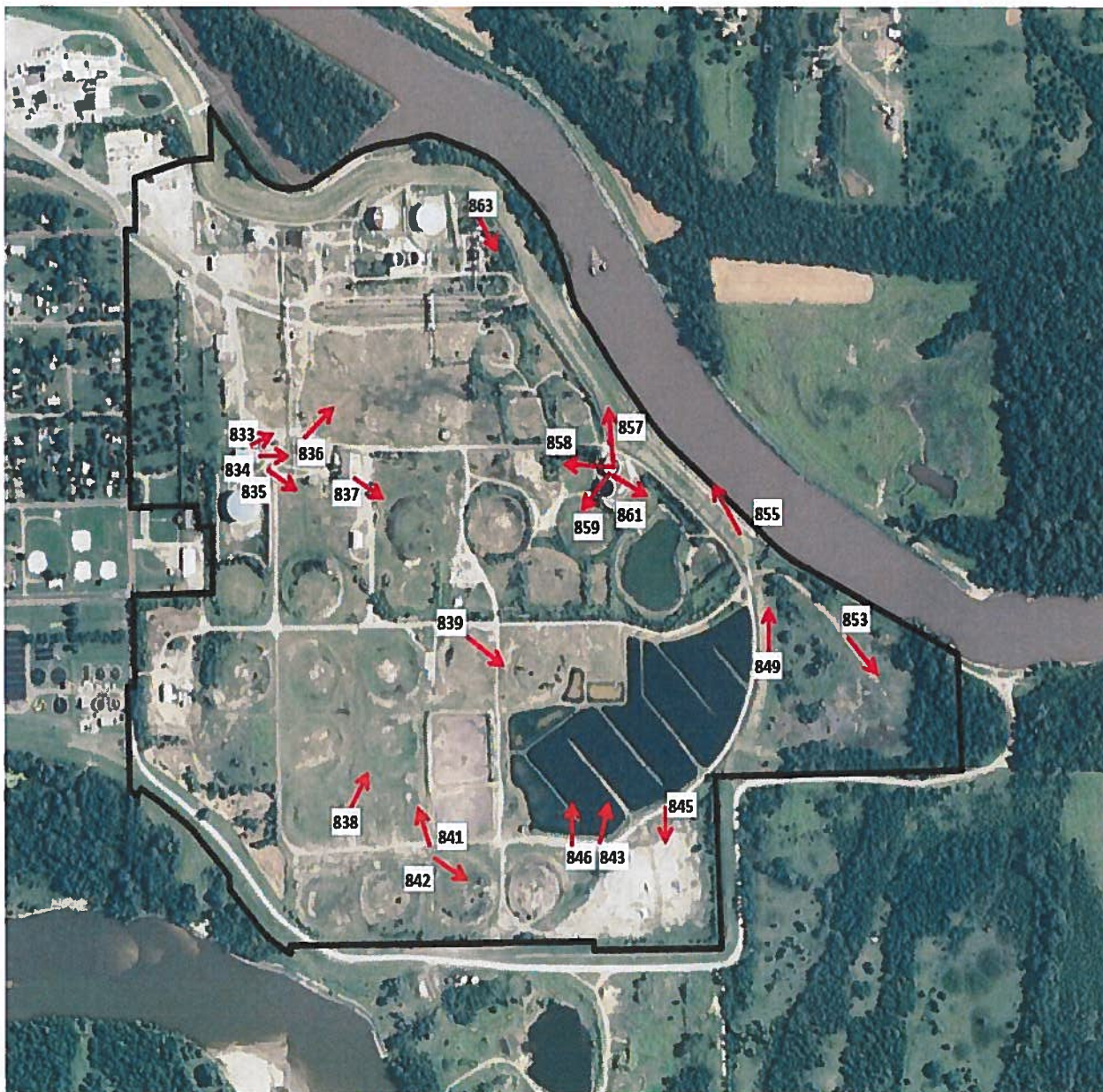
Figure No.:

3-1



Appendix A

Photographic Log



Client:	MRP Properties Company, LLC.	Project:	SLERA for Soil, Surface Water, and Sediment
Site Name:	Former Total Petroleum Refinery	Site Location:	Arkansas City, Kansas








Client:	MRP Properties Company, LLC.	Project:	SLERA Work Plan for Soil, Surface Water, and Sediment
Site Name:	Former Total Petroleum Refinery	Site Location:	Arkansas City, Kansas
Photograph ID: 1			
Photo Location: 833			
Direction: northeast			
Survey Date: 8/6/2014			
Photograph ID: 2			
Photo Location: 834			
Direction: east			
Survey Date: 8/6/2014			






Client:	MRP Properties Company, LLC.	Project:	SLERA Work Plan for Soil, Surface Water, and Sediment
Site Name:	Former Total Petroleum Refinery	Site Location:	Arkansas City, Kansas
Photograph ID: 3			
Photo Location: 835			
Direction: southeast			
Survey Date: 8/6/2014			
Photograph ID: 4			
Photo Location: 836			
Direction: northeast			
Survey Date: 8/6/2014			

Client:	MRP Properties Company, LLC.	Project:	SLERA Work Plan for Soil, Surface Water, and Sediment
Site Name:	Former Total Petroleum Refinery	Site Location:	Arkansas City, Kansas
Photograph ID: 5			
Photo Location: 837			
Direction: southeast			
Survey Date: 8/6/2014			
Photograph ID: 6			
Photo Location: 838			
Direction: northeast			
Survey Date: 8/6/2014			


Client:	MRP Properties Company, LLC.	Project:	SLERA Work Plan for Soil, Surface Water, and Sediment
Site Name:	Former Total Petroleum Refinery	Site Location:	Arkansas City, Kansas


Photograph ID: 7	
Photo Location: 839	
Direction: southeast toward oxidation ponds	
Survey Date: 8/6/2014	



Photograph ID: 8	
Photo Location: 841	
Direction: southeast	
Survey Date: 8/6/2014	

Client:	MRP Properties Company, LLC.	Project:	SLERA Work Plan for Soil, Surface Water, and Sediment
Site Name:	Former Total Petroleum Refinery	Site Location:	Arkansas City, Kansas
Photograph ID: 9			
Photo Location: 842			
Direction: southeast			
Survey Date: 8/6/2014			
Photograph ID: 10			
Photo Location: 843			
Direction: northwest			
Survey Date: 8/6/2014			



Client:	MRP Properties Company, LLC.	Project:	SLERA Work Plan for Soil, Surface Water, and Sediment
Site Name:	Former Total Petroleum Refinery	Site Location:	Arkansas City, Kansas

Photograph ID: 11	
Photo Location: 845	
Direction: south	
Survey Date: 8/6/2014	



Photograph ID: 12	
Photo Location: 846	
Direction: northwest	
Survey Date: 8/6/2014	

Client:	MRP Properties Company, LLC.	Project:	SLERA Work Plan for Soil, Surface Water, and Sediment
Site Name:	Former Total Petroleum Refinery	Site Location:	Arkansas City, Kansas
Photograph ID: 13			
Photo Location: 849			
Direction: north			
Survey Date: 8/6/2014			
Photograph ID: 14			
Photo Location: 853			
Direction: southeast			
Survey Date: 8/6/2014			





Client:	MRP Properties Company, LLC.	Project:	SLERA Work Plan for Soil, Surface Water, and Sediment
Site Name:	Former Total Petroleum Refinery	Site Location:	Arkansas City, Kansas
Photograph ID: 15			
Photo Location: 855			
Direction: northwest			
Survey Date: 8/6/2014			
Photograph ID: 16			
Photo Location: 857			
Direction: north			
Survey Date: 8/6/2014			



Client:	MRP Properties Company, LLC.	Project:	SLERA Work Plan for Soil, Surface Water, and Sediment
Site Name:	Former Total Petroleum Refinery	Site Location:	Arkansas City, Kansas
Photograph ID: 17			
Photo Location: 858			
Direction: west			
Survey Date: 8/6/2014			
Photograph ID: 18			
Photo Location: 859			
Direction: southwest, toward Former Tank Farm			
Survey Date: 8/6/2014			

Client:	MRP Properties Company, LLC.	Project:	SLERA Work Plan for Soil, Surface Water, and Sediment
Site Name:	Former Total Petroleum Refinery	Site Location:	Arkansas City, Kansas

Photograph ID: 19	
Photo Location: 861	
Direction: southeast, toward levee and off-Site	
Survey Date: 8/6/2014	

Photograph ID: 20	
Photo Location: 863	
Direction: southeast	
Survey Date: 8/6/2014	